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CATALOGUE

OF THE

FOSSIL FISHES

IN THE

BRITISH MUSEUM

(NATURAL HISTORY),

CROMWELL ROAD, S.W.

PART I.

CONTAINING THE

ELASMOBRANCHII.

BY

ARTHUR SMITH WOODWARD,
F.G.S., F.Z.S.

FOSSIL FISHES LIBRARY

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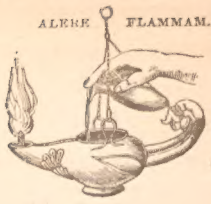

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PREFACE.

Of the many varied and rich collections embraced within the Museum there is probably none which contains so large an assemblage of "types" as that of the Fossil Fishes. Many of the specimens have been preserved for more than a hundred years, indeed ever since the foundation of the Museum; but it was during the Keepership of the late Mr. Charles König (1813–1851) that the fossil fish collection first assumed a separate and marked importance. It was most fortunate that the task commenced by Mr. König should have been steadily followed up by Mr. William Davies (1843–1887), by whom it was relegated to Mr. Arthur Smith Woodward, who entered the Museum in 1882; so that the history of every specimen has, as a rule, been carefully preserved and safely handed down to the present time.

The additions made by separate purchases, and by donations, extending over so many years, have greatly augmented the series, but the acquisition of the Collections of Mantell, Dixon, Bowerbank, Häberlein, van Breda, Capron, Lewis, and, most of all those of Egerton and Enniskillen, has raised the present standard of this magnificent Gallery of Fossil Fishes higher than that in any other Museum in the world.

No class of organisms are better represented in our rocks than are fishes, although, particularly in the present subclass, we have reason to regret their too frequent fragmentary condition, yet recent researches have shed such a flood of light upon these ancient

Elasmobranchs as not only clearly to show us the characters and relationships of many obscure fossil forms, but often to aid us towards a more correct interpretation of their living representatives.

With the exception of an Alphabetical Catalogue of the Type-specimens of Fossil Fishes preserved in the British Museum prepared by Mr. William Davies, F.G.S., and published in the GEOLOGICAL MAGAZINE for 1871 (pp. 208 & 334), no previous attempt had been made to catalogue this Collection.

Although Mr. Arthur Smith Woodward has only been able to devote a small part of his official time during the past seven years to the study of Fossil Fishes, he has nevertheless made most excellent use of all his opportunities, and having enjoyed the constant advice and assistance of Mr. William Davies, and been in frequent communication with Dr. R. H. Traquair, Dr. Günther, and many other eminent Ichthyologists, the present volume will be found worthy to rank with similar publications as a valuable contribution to systematic Zoology and a most useful and accurate reference-Catalogue for Palæontologists and Ichthyologists.

HENRY WOODWARD.

Geological Department,
9th March, 1889.

INTRODUCTION.

The present volume being the first attempt at a systematic treatment of the Palæontology of the Elasmobranch fishes, it seems a fitting occasion for briefly reviewing the bearing of the newly-collected evidence upon the various results that have already been attained in the study of the existing members of this great subclass. Notwithstanding its imperfections, Palæontology must necessarily be employed as the test—if it be not adopted as the basis—for all morphological and taxonomic speculations; and though the pages of the Catalogue may indicate extreme imperfection in our knowledge of the past history of most groups, there are still a few well-ascertained facts which may be already profitably discussed with reference to the conclusions of recent Zoology.

It is therefore proposed:—firstly, to enumerate the principal stages by which the most modern schemes of classification of the group have been elaborated; secondly, to summarize the known and available palæontological resources; thirdly, to recapitulate the more important palæontological results; and lastly, to discuss these results in the light of modern theories of taxonomy.

Taxonomic Deductions from the Study of Recent Elasmobranchs.

From the time of Aristotle and Pliny, fishes with a cartilaginous skeleton have been more or less clearly distinguished from those possessed of well-formed bones; and when Willughby and Ray inaugurated the era of modern Ichthyology in 1686, they assigned to the "Pisces Cartilaginei" the lampreys, sharks, rays, and sturgeons[1]. In 1738, Artedi[2] confirmed this arrangement, elaborating details, and applying the name of Chondropterygii to an "order" comprising the existing types just mentioned; and Linnæus[3] after-

[1] J. Raius, F. Willughbeii de Historia Piscium (1686), p. 22.

[2] P. Artedi, Ichthyologia, pt. v. (1738), p. 89.

[3] C. Linnæus, Systema Naturæ, 12th edit.

orders of a subclass, though only allowing the difference to rank of equal importance with that observed between the Acanthopterygian and Anacanth Teleosteans.

In 1870, Dr. Günther[1] once more adopted Bonaparte's classification, altering the nomenclature, however, and terming the subclasses Chondropterygii and Cyclostomata respectively, and the orders of the former, *Plagiostomata* and *Holocephala*; while the Plagiostomes were further divided into the suborders of Selachoidei and Batoidei. A year later[2], the Chondropterygii, thus defined, became an order of Dr. Günther's newly instituted subclass Palæichthyes, the Plagiostomata and Holocephala then being suborders, and the Selachoidei and Batoidei merely sections.

At the same time, Prof. Cope[3] proposed a precisely reverse modification, the Sharks and Rays to form one subclass (Selachi) and the Chimæras another (Holocephali); this arrangement being based upon the fundamental difference in the structure of the skull, already indicated in Bonaparte's second term. In 1876, Prof. Huxley[4] adopted Cope's wide separation of these two groups, but regarded them as orders, and preferred the term Plagiostomi to that of Selachi. Most modern researches have also tended to emphasize the distinction between fishes with autostylic[5], and those with hyostylic[6] skulls, both among those without membrane-bones and those possessing these skeletal elements; and such is the arrangement selected for adoption on the present occasion.

With regard to terminology, it will be observed that the significance of each name already adopted has considerably varied according to the views of the respective authors. The only term originally restricted to the cartilaginous hyostylic fishes is that of "Plagiostomi," proposed by C. Duméril; but this is both inappropriate in many instances, and also based upon a misconception of the supposed relationships existing between the lampreys and the sharks. We therefore venture to follow Prof. Cope in adopting Bonaparte's name, Elasmobranchii, excluding the Holocephali, and elevating these to the rank of an equivalent subclass.

In subdividing the Elasmobranchii, thus defined, almost all natu-

[1] A. C. L. G. Günther, Catalogue of the Fishes in the British Museum, vol. viii. (1870), pp. 348, 353, 499.

[2] Phil. Trans. 1871, p. 554.

[3] E. D. Cope, Proc. Amer. Assoc. Adv. Sci. 1871, p. 326.

[4] H. T. Huxley, Proc. Zool. Soc. 1876, p. 57.

[5] *I. e.*, skull without separate suspensorium.

[6] *I. e.*, skull with separate suspensorium.

In 1883, Prof. Gill[1] adopted the orders SQUALI (Sharks) and RAJÆ (Rays), and employed the results of Gegenbaur's researches upon the skull in subdividing the latter, proposing to recognize four main groups. The Notidanidæ, with a postorbital articulation between the pterygo-quadrate and the cranium, were named *Opistharthri*; the Cestraciontidæ, with an antorbital articulation, the *Proarthri*; the modern types of Sharks, the *Anarthri*; and the Squatinidæ, the *Rhinæ*. In 1884, the first three divisions just named were also adopted by Prof. Cope[2]; but the *Rhinæ* were now merged with the *Anarthri*.

An examination of a large series of skulls and skeletons by Prof. Haswell, in 1884[3], also led him to diagnose great subdivisions by endoskeletal characters. The proposed arrangement, however, differed but little from that of Dr. Günther, the Selachoidei being only further subdivided into *Palæoselachii* (=Notidanidæ) and *Neoselachii* (=other Sharks).

About the same time, the discovery of *Chlamydoselache* by Mr. Garman[4] induced him to add to the orders Galei (=Selachoidei) and Batoidei, a supposed new order, Selachophichthyoidei, characterized by "vertebræ partially or imperfectly developed, a persistent notochord, and teeth with broad backward-expanded bases;" but in 1885[5], this proposition was withdrawn, the new genus being placed with *Cladodus* in a division of the Galei.

The discovery of *Chlamydoselache*, and the resemblance of its dentition to the fossil teeth named *Diplodus* also excited the interest of Prof. Cope, and led to the first attempt at a scientific description of a Palæozoic Elasmobranch skull[6]. Sufficient materials had been obtained from the Permian beds of Texas to indicate that a fish possessing teeth of the *Diplodus*-type presented an arrangement of the mandibular and hyoid arches extremely similar to that observed in the living *Notidanus*; and the supposed presence not only of a few definite tracts of ossification in the chondrocranium, but also of imperfect membrane-bones, was considered to justify the recognition of a new order of the Elasmobranch subclass, to be termed ICHTHYOTOMI. This order was made to include the Hybodontidæ, as de-

[1] T. Gill, Bull. U. S. National Museum, no. 16 (1883), p. 967.

[2] E. D. Cope, Proc. Amer. Phil. Soc. 1884, p. 580.

[3] W. A. Haswell, Proc. Linn. Soc. N. S. Wales, vol. ix. (1884), pp. 71–119, pls. i. & ii.

[4] S. Garman, Science, vol. iii. (1884), p. 117.

[5] S. Garman, Bull. Mus. Comp. Zoology Harvard Coll. vol. xii. no. 1 (1885), p. 30.

[6] E. D. Cope, Proc. Amer. Phil. Soc. 1884, pp. 572–590, with plate.

mains of skeletons, which afford important information concerning features of real Biological significance and value.

The preliminary sketch of Agassiz has been followed by numerous publications of greater or less extent, and nearly all of these, it is hoped, are noticed in the present Catalogue. Many are brief descriptions in geological treatises, but several are of a more special kind and worthy of enumeration.

The detached teeth and spines of Carboniferous Elasmobranchs have been described in Britain by F. M'Coy [1] and J. W. Davis [2]; in Belgium by L. G. de Koninck [3] and M. Lohest [4]; in Russia by H. Romanowsky [5] and H. Trautschold [6]; and in the United States by J. S. Newberry [7] and O. St. John [8], partly in conjunction with A. H. Worthen [9]. Only four types of Carboniferous dentition, however, are known with much completeness [10]; and the only skeletons worthy of note are those of *Sphenacanthus* (p. 242), *Chondrenchelys* (p. 15), and *Cladodus* (p. 26), from the Lower Carboniferous of Scotland; "*Cladodus*" from the Erie Shale of Ohio (p. 457); and *Pleuracanthus* [11], from the Middle Coal-Measures of

[1] In A. Sedgwick and F. M'Coy, British Palæozoic Rocks and Fossils, 4to, Cambridge, 1855.

[2] J. W. Davis, "On the Fossil Fishes of the Carboniferous Limestone Series of Great Britain," Trans. Roy. Dublin Soc. [2] vol. i. (1883), pp. 327-600, pls. xlii.–lxv.

[3] L. G. de Koninck, "Faune du Calcaire Carbonifère de la Belgique," pt. i. (in Ann. Mus. Roy. d'Hist. Nat. Belg. vol. ii. 1878).

[4] M. Lohest, "Recherches sur les Poissons des Terrains Paléozoïques de Belgique," Ann. Soc Géol. Belg. vol. xi. (1882), pp. 295–325, pls. iii.–v.

[5] H. Romanowsky, "Description de quelques Restes de Poissons Fossiles trouvés dans le Calcaire Carbonifère du Gouvernement de Toula," Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. pp. 157–170, pls. iii., iv.

[6] H. Trautschold, "Fischreste aus dem Devonischen des Gouvernments Tula," Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), pp. 261–276, pls. xxvi., xxvii. Also "Die Kalkbrüche von Mjatschkowa," *ibid.* pp. 277–299, pls. xxviii., xxix., and vol. xiv. (1879), pp. 49–61, pls. vi., vii.

[7] In the Reports of the Geological Survey of Ohio, vol. i. pt. ii. (1873), and vol. ii. pt. ii. (1875). Also in the Annual Report of the Geological Survey of Indiana, 1876-78 (1879), pp. 341-348.

[8] In Hayden's Final Report of the Geological Survey of Nebraska (1872).

[9] Geological Survey of Illinois, vols. ii. (1866), iv. (1870), vi. (1875), and vii. (1883).

[10] *Cladodus* (p. 25), *Archæobatis* (p. 108), *Psephodus* (p. 178), and *Cochliodus* (p. 208).

[11] C. Brongniart, Etudes sur le Terrain Houiller de Commentry.—Faune Ichthyologique, pt. i. (1888).

papers [1]; the corresponding fossils of France are noticed by P. Gervais (*op. cit.*) and H. E. Sauvage [2]; of Switzerland by F. J. Pictet and G. Campiche [3]; of Saxony and Bohemia by A. E. Reuss [4], H. B. Geinitz [5], and A. Fritsch [6]; of Russia by V. Kiprijanoff [7]; of India by Egerton [8] and Stoliczka [9]; and of the United States by E. D. Cope [10] and J. Leidy [11]. A few important skeletons are known from the Senonian Beds of Westphalia [12]; and the uppermost Cretaceous deposits of Mount Lebanon have furnished numerous well-preserved fishes, first noticed in detail by J. W. Davis [13], but considerably revised in the present volume.

The innumerable Selachian teeth of Tertiary age, discovered in almost all marine deposits, are described in several extensive memoirs. In England, many are noticed by F. Dixon (*op. cit.*); those of France are made known by P. Gervais [14], F. Bassani [15], and

[1] See Smith Woodward, "A Synopsis of the Vertebrate Fossils of the English Chalk," Proc. Geol. Assoc. vol. x. (1888), pp. 286–298.

[2] H. E. Sauvage, "Recherches sur les Poissons Fossiles du Terrain Crétacé de la Sarthe," Bibl. Ecole Hautes Etudes, vol. v. no. 9 (1872).

[3] Pictet and Campiche, "Description des Fossiles du Terrain Crétacé des Environs de Sainte-Croix," pt. i. (1858–60), in Pictet's Paléont. Suisse, sér. 2. Also F. J. Pictet, "Description des Poissons Fossiles du Terrain Néocomien des Voirons" (1858), *ibid.*

[4] A. E. Reuss, Versteinerungen der böhmischen Kreideformation, 1845–6.

[5] H. B. Geinitz, "Das Elbthalgebirge in Sachsen," Palæontographica, vol. xx. pts. i., ii. (1871–75).

[6] A. Fritsch, Reptilien und Fische der böhmischen Kreideformation, 1878.

[7] V. Kiprijanoff, "Fisch-Ueberreste im Kurskschen eisenhaltigen Sandsteine," Bull. Soc. Imp. Nat. Moscou, 1852, 1853, 1854, 1855.

[8] Sir P. Egerton, "On the Remains of Fishes found by Mr. Kaye and Mr. Cunliffe in the Pondicherry Beds," Quart. Journ. Geol. Soc. vol. i. (1845), pp. 164–171.

[9] F. Stoliczka, "The Cretaceous Fauna of Southern India" (Palæontologia Indica), vol. iv. pt. 4 (1873).

[10] E. D. Cope, "Vertebrata of the Cretaceous Formations of the West," Rep. U. S. Geol. Surv. Territ. vol. ii. (1875).

[11] J. Leidy, "Contributions to the Extinct Vertebrate Fauna of the Western Territories," *ibid.* vol. i. pt. 1 (1873).

[12] *Squatina baumbergensis* (p. 68), *Scyllium angustum* (p. 340), and *Palæoscyllium decheni* (p. 343).

[13] J. W. Davis, "The Fossil Fishes of the Chalk of Mount Lebanon, in Syria," Trans. Roy. Dublin. Soc. [2] vol. iii. (1887), pp. 468–494, pls. xiv.–xxi.

[14] *Op. cit.*, and 'Zoologie et Paléontologie Générales,' 1867–69.

[15] F. Bassani, "Richerche sui Pesci Fossili del Miocene Medio di Gahard (Ille-e-Vilaine) in Francia," Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. (1879), pp. 43–70, with plate.

are those from the Upper Eocene of Monte Bolca[1] and Monte Postale[2] in North Italy, described by Heckel, Molin, A. de Zigno, and others; and from the Green River Shales of Wyoming, U.S.A., described by Prof. Cope[3].

Synopsis of Palæontological Results.

Summarizing the general results of these discoveries and investigations, and adding much that is new, suggested by a study of the British-Museum Collection, the main points of biological significance may be briefly enumerated as follows:—

Cartilage.

Even among Elasmobranchs so early as those of the Lower Carboniferous, the cartilages exhibit a considerable amount of calcification. A few Carboniferous genera, such as *Pleuracanthus* (p. 2) and *Hybodopsis* (p. 240), display the well-known superficial crust of polygonal calcified tesseræ upon the cartilage; but a considerable number of the older skeletons seem to exhibit a more penetrating and irregular distribution of the centres of calcification than is common among types of a later date. It is also interesting to note that in the Lower Carboniferous *Chondrenchelys* (p. 15) and the late Palæozoic *Pleuracanthus* the slender cartilages present a curious concretionary arrangement of the calcareous salts, imparting to them a beaded appearance.

Head and Visceral Arches.

Concerning the cranium itself in extinct Elasmobranchs, there is at present very little information. Mr. Garman[4] has already pointed out that there is much reason to suspect a misconception in Prof. Cope's statements as to the presence of distinct bony elements in the skull of the Ichthyotomi; and, if so, the only other divergence that has yet been noted between the cranium of these early Elasmobranchs and the modern type is the possible presence of a basal membrane-bone (parasphenoid) in *Chondrenchelys* (p. 15).

Among later Selachians there are a few instances in which a

[1] *Rhinobatus primævus* (p. 82), *Platyrhina holcensis* (p. 459), *Myliobatis gazolai* (p. 124), *Torpedo egertoni* (p. 90), *Torpedo gigantea* (p. 90), species of *Trygon* (p. 153), *Mesteria emilia* (p. 346), and *Protogaleus cuvieri* (p. 437).

[2] *Trygonorhina dixignii* (p. 83) and *Urolophus princeps* (p. 154).

[3] *Xiphotrygon acutidens* (p. 154).

[4] Bull. Mus. Comp. Zoology Harvard Coll. vol. xii. no. 1 (1885), p. 29.

well-marked type of skull is definitely known to persist for long periods; and in this connection the case of *Squatina*, ranging from the Jurassic to the present day, may be particularly mentioned.

Still more interesting, however, is the light Palæontology seems destined soon to shed upon the history of some of the more specialized skulls. The remarkable snout of the well-known *Pristis* seems to date back at least to the Eocene period, though even at this time there are apparently some forms not quite reaching the modern stage in which the lateral teeth are all implanted in firm cartilage [1]; but in Cretaceous rocks no Selachian with so highly-specialized a rostrum has yet been found, and the discovery at Mount Lebanon of a sawfish [2] in which the rostral teeth are very small and only in part in contact with the cartilages is thus of extreme interest, and perhaps of considerable significance.

The mandibular and hyoid arches are known in "*Didymodus*," Cope, of the Permian; in *Palæospinax* of the Lias; in *Hybodus* of the Wealden; and in *Synechodus* of the Chalk. In all of these extinct types the hyomandibular element appears to be more slender than in the majority of living Selachians; and in "*Didymodus*" and *Synechodus* (p. 325) a postorbital facette has been observed upon the pterygo-quadrate cartilage, evidently implying a direct articulation with the cranium, such as occurs in the adult of the surviving primitive genus *Notidanus*. The examples of *Palæospinax* and *Hybodus* noted in the following Catalogue seem to be sufficiently well preserved to demonstrate that no such arrangement obtained in these genera.

A point of minor importance in connection with the mandible of one extinct genus is also worthy of note, on account of its yet awaiting satisfactory explanation. The Cestraciont genus *Asteracanthus* (p. 307) is provided with perhaps the most powerful dental armature of all the Sharks possessing crushing teeth; and most likely for this reason there is evidence of some unusual arrangement or development of the muscles by which the successful wielding and support of the jaws are ensured. On the outer side of the mandibular cartilage [3], slightly in advance of a point halfway between the condyle and the anterior extremity, there is a large protuberance or boss; much of the external surface of the cartilage has a coarsely fibrous appearance, and at the position of this curious prominence

[1] *Propristis* (p. 76).

[2] *Sclerorhynchus* (p. 76).

[3] See figure and description by the present writer in Ann. Mag. Nat. Hist. [6] vol. ii. (1888), p. 337, pl. xii. fig. 1.

these fibres are directed in such a manner as to suggest the original influence of some powerful strain tending in an upward and backward direction.

The branchial arches have only been definitely revealed in one extinct Selachian—*Hybodus basanus*, from the Wealden of Sussex. In this species, and hence presumably in all forms of *Hybodus*, there are not more than five arches, as well shown in the original of Pl. XII. fig. 3, in which the fourth and fifth are very small, and can scarcely have been followed by others.

Vertebral Column.

Before the end of Palæozoic times there is very little evidence of calcifications in the sheath of the notochord in Elasmobranchs; and even when such a stage of development is approached there seems to be no constriction. Hasse has noticed the presence of complete calcified rings in the caudal region of a Permian species of *Pleuracanthus* (p. 4); and Traquair records an equally high condition of development in the tail of the Lower Carboniferous *Chondrenchelys* (p. 15). Some specimens of *Pleuracanthus* are also suggestive of the presence of distinct triangular calcifications in the notochordal sheath in the abdominal region; but it is still uncertain whether these may not be merely the expanded bases of the neural arches.

The early species of the genus *Hybodus*, discovered in the Lower Lias, are also destitute of vertebræ, at least in the abdominal region; and it is especially interesting to observe an almost equally primitive condition of the neural arches and spines (Pl. VII. fig. 2). The latter are relatively broader and stouter than in the Palæozoic Pleuracanths, but there is still not the slightest trace of the intercalary cartilages so characteristic of modern Selachians; and this circumstance becomes all the more noteworthy when it is remembered that, among living Sharks, the intercalary elements are secondary structures, arising subsequently to the normal parts of the vertebral axis.

The first traces of completed vertebral centra are met with in the Cestraciont *Palæospinax* of the Lower Lias—a fish exhibiting other features denoting its comparatively high degree of specialization. Here, however, the centra are for the most part simple double cones, such as persist in the living Spinacidæ, and only the faintest indications of the secondarily developed peripheral calcifications can

be detected. Another Cestraciont genus of Cretaceous age (*Synechodus*), which can scarcely be distinguished from *Palæospinax* in the characters of its dentition and external dermal structures, possesses fully-formed vertebræ of the asterospondylic type.

Truly asterospondylic vertebræ, indeed, are already met with in the *Cestracion falcifer* (p. 332) of the Lithographic Stone; and the representatives of *Squatina* and *Rhinobatus* of the same age furnish equally typical examples of well-formed tectospondylic vertebræ. In the Jurassic species of *Squatina*, however, Dr. Hasse[1] has pointed out that the number of peripheral calcified rings in the vertebræ is less than in the later species of the same genus.

Pectoral Arch and Fins.

The remains of the pectoral arch in the earliest known Elasmobranchs indicate that it consisted of a pair of arched cartilages, one upon either side, probably separated in the median line. It would be interesting to know at what period, and in what form, the separation of the supra-scapular cartilage in the Rays first occurred, and how early the two lateral elements united in any of the Tectospondyli to form a complete girdle; but evidence upon all these points is at present wanting.

Each new discovery of the most primitive types of Elasmobranchs seems to render the conclusion more certain, that the earliest stage of the pectoral fin was that named the "archipterygium" by Gegenbaur[2]. As pointed out by Goldfuss and Kner, and more recently by Anton Fritsch and C. Brongniart, this appendage in the Palæozoic *Pleuracanthus* exhibits a long segmented axis, fringed on either side with cartilaginous rays; and a nearly similar arrangement has lately been discovered by Traquair in *Cladodus* (p. 16), though in this genus the fin may have possessed rays only upon one side of the longitudinal axis. There is still some slight approach to such an archipterygial type in the pectoral fin even of a few living Selachians[3], and, if the known examples of the pectoral fin of *Pleuracanthus* suffice for philosophical discussion, the central axis is formed by the metapterygium, as Gegenbaur supposed, and

[1] Natürl. Syst. Elasmobr., Besond. Theil, p. 132.

[2] C. Gegenbaur, "Ueber das Archipterygium," Jena. Zeitschr. vol. vii. (1873) pp. 131–141, pl. x.

[3] C. Gegenbaur, *ibid.*

not by the mesopterygium, as maintained by Huxley [1], Balfour [2], and Howes [3]. In the majority of Selachians, however, the pectoral is completely shortened and so much modified that the homologies of the parts are difficult of determination; and this stage appears to have been already reached even in a Lower Carboniferous Shark [4], which possessed a dentition indistinguishable from that of *Cladodus*.

In the pectoral fin of the Lower Liassic *Palæospinax* the type characteristic of the modern Shark is also evident, and there are a few robust dermal fin-rays. It is uncertain, however, whether any genus at this time, or of prior date, had become possessed of cartilaginous pectoral fin-rays so enormously developed as to constitute a fin comparable to that of the existing Rays. The fossils named *Arthropteras* and *Cyclarthras* (p. 156), from the Lias, are supposed to be most satisfactorily interpreted as being parts of such fins: but the specimens are scarcely sufficient for profitable discussion. The Lower Carboniferous teeth named *Psammodus* (p. 99) are also most nearly paralleled at the present day by those of fishes with an extremely depressed trunk and enormously developed pectorals without dermal rays; but these fossils likewise afford no basis for reasonable speculation.

Pelvic Arch and Fins.

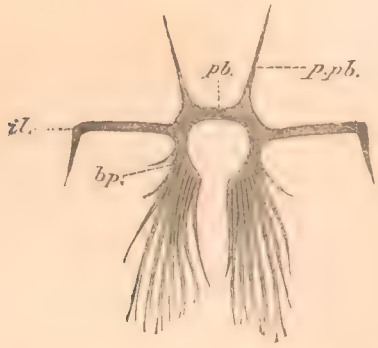
The pelvic fins in the earliest genus in which they are known (*Pleuracanthus*) exhibit the usual series of rays upon one side of the basipterygial axis; and in the male there is a distinct appended clasper. The pelvis of *Pleuracanthus* is more singular than the pair of fins, inasmuch as it consists of two triangular cartilages, one on either side, only meeting and not united in the mesial line.

The pelvic arch and fins in the extinct Mesozoic genera are known in but few instances; and only one case is worthy of special remark. In a Cretaceous member of the Trygonidæ (*Cyclobatis*), the arch seems to be modified for the support of the metapterygium of the enormously developed pectoral fins. The "prepubic" process (*p.pb.*, fig. A, p. xx) in this genus is much elongated and produced forwards; and a lateral process (*il.*) on either side, apparently

[1] Proc. Zool. Soc. 1876, p. 55.
[2] Comparative Embryology, vol. ii. (Reprint, 1885), p. 617.
[3] Proc. Zool. Soc. 1887, p. 24.
[4] *Sphenacanthus costellatus* (p. 242).

homologous with the "iliac," is not only of great length, but has also sharply reflected extremities, which seem to have been originally

Fig. A.



Pelvic cartilage of *Cyclobatis oligodactylus*.—Senonian, Mount Lebanon. *bp.*, basal cartilage of pelvic fin; *il.*, iliac process; *pb.*, pubic cartilage; *p.pb.*, prepubic process. [From Proc. Zool. Soc. 1888, p. 128.]

in direct connection with the distal end of the pectoral metapterygium.

Median Fins.

A Lower Carboniferous species of *Sphenacanthus* (p. 242) presents as highly specialized an arrangement of the median fins as most modern Sharks; but in the primitive *Chondrenchelys* of the same age, and in the late Palæozoic *Pleuracanthus*, a lower stage of development persists. In *Chondrenchelys* there was evidently a long undifferentiated median fin, with at least one series of slender supporting cartilages above the neural spines. In *Pleuracanthus* (according to C. Brongniart) a long dorsal fin is separated from the diphycercal caudal; and there is also said to be a small separate "cephalic" fin supported by the barbed spine—a feature of which the spine itself affords no evidence. As pointed out by R. Kner[1], the series of interspinous cartilages supporting the dorsal fin is double; and C. Brongniart shows these elements to be twice as numerous as the neural arches, each of the neural spines distally bifurcating to support them (see fig. B, p. xxiv). Very striking in *Pleuracanthus*, on the other hand, is the specialization of the median

[1] Sitzungsb. math.-naturw. Cl. k. Akad. Wiss. Wien, vol. lv. (1867), pls. i., ii., x.

fin in the anal region; it is divided into two distinct members, closely following each other, and exhibiting a singular arrangement of the cartilages, most nearly parallelled, so far as known, in the first dorsal fin of the common existing *Raja* [1].

Shagreen and Dermal Defences.

A noteworthy feature in the Palæontological history of the Elasmobranchs is the relatively great development of the exoskeleton in the majority of the early genera. *Pleuracanthus* and *Chondrenchelys*, it is true, seem to have been almost, if not quite, destitute of shagreen; and the former, at least, possessed but a single spine. But the abundance of Ichthyodorulites, both paired and median, in the older rocks, testifies to the frequent armature of the body; and Mesozoic genera, like *Hybodus* and *Acrodus*, show how not only the dorsal fins, but also the sides of the head, were provided with formidable spines.

Moreover, the early types of shagreen and spinous defences are remarkable for their degree of sculpturing. The small conical tubercles in the skin of *Hybodus* and *Acrodus* (and the presumably equivalent Carboniferous fossils named *Petrodus*) exhibit a sometimes elaborate stellate ornamentation: and these bodies do not usually form so compact and continuous an investment as the small quadrate granules, characteristic of modern Sharks, which are apparently first met with in *Janassa*, of the Permian.

Smooth dorsal fin-spines are also rare in Palæozoic rocks, being only known at present in the Carboniferous *Pleuroplax* and *Helodus*; and the earliest smooth spines covered with ganoine are those of the Rhætic and Liassic *Palæospinax*. Except in *Pleuroplax* and *Helodus*, the spines of Palæozoic age are all more or less sculptured upon the sides, or exhibit two series of powerful denticles. In the sculptured laterally-compressed forms of this period, the denticles are placed longitudinally in a series upon each edge of the posterior face; but in later times very few spines, except those of Chimæroids, continue to exhibit such an arrangement, the denticles becoming still more prominent and approximating to form a double series along the middle of the posterior face.

Paired spines doubtless referable to Elasmobranch or Chimæroid fishes are numerous in Carboniferous strata, and will be treated in the section upon Ichthyodorulites [2]. Many are triangular, and

[1] See figure by Mivart, Trans. Zool. Soc. vol. x. pl. lxxviii. fig. 7.

[2] Following the Holocephali, in Part II. of this Catalogue.

attain to a considerable size (e. g., *Oracanthus*); and these may have been arranged upon the ventral surface (like the spines of Acanthodians), or may perhaps have occupied the postero-lateral angles of the head (like the cornua of Cephalaspidians); some, however are long and slender, and seem to have armed the front margin of the pectoral or pelvic fins. In the Mesozoic *Hybodus*, *Acrodus*, and *Asteracanthus*, two pairs of large hooked spines upon broad bases also occupied the lateral regions of the head: but no discovery of paired fin-spines in deposits later than the Permian has yet been recorded.

Dentition.

Pointed teeth and obtuse teeth occur among the earliest Elasmobranch fossils: but the former, as well as the latter, are firmly articulated together, and must always have formed part of a dentition in which several series were functional. Though the teeth of *Cladodus* and *Diplodus* are as sharply pointed as those of most recent Sharks, the piercing crown is placed upon a broad horizontally-expanded base, permitting of a considerable amount of interlocking between one tooth and another—an arrangement most nearly parallelled in the surviving *Chlamydoselache*. It is evident, indeed, that all the modern types of dentition, in which not more than one or two series of teeth are simultaneously functional, are highly specialized modifications of this primitive arrangement; and the change results from the deepening and lateral compression of the root of each tooth, rendering its base of support less fixed, and often not permitting its coming into use until after attaining the summit, or passing to the outer side, of the jaw-cartilage.

In rare instances, the stages of this interesting course of specialization can already be traced to a certain extent; and no case is more striking than that of the genus *Notidanus*[1]. In the earliest known Jurassic species, the teeth possess few coronal cusps, fixed upon a stout, depressed, and backwardly-expanded base of attachment; in the Upper Cretaceous species the crown is longer, and the root or base exhibits considerable lateral compression: and in the Pliocene species the tooth possesses the greatest number of cusps, and its root is both very deep and extremely compressed. If *Orthacodus* is rightly placed in the Lamnidæ, this, too, is an illustration of the same principle. The Jurassic tooth just mentioned has a broad hori-

[1] Geol. Mag. [3] vol. iii. (1886), p. 257.

zontally-expanded root, while all later forms are characterized by a deeper and more or less bifurcated base of attachment.

With regard to the disposition of the teeth in the mouth as a whole, the modern Rays, most Scylliidæ, and *Chlamydoselache* may be looked upon as retaining the most primitive arrangement. In the predaceous Sharks there has been a tendency towards the relative enlargement of the prehensile teeth upon the symphysis; in the *Cestracion*-like Sharks the symphysial teeth have become small, though prehensile, and the lateral teeth well adapted for trituration. The former arrangement is particularly characteristic of modern times; the latter, it is interesting to note, attained its maximum of specialization so long ago as the Carboniferous period. In many early Carboniferous genera the series of lateral crushing-teeth began in part to fuse into continuous plates (*Pleuroplax*); two of these plates often amalgamated (*Pœcilodus*); and in the most specialized of these "Cochliodonts" (e. g., *Deltoptychius*) all traces of the boundaries of the original components of the dental plates became obliterated.

Taxonomic Deductions from the Comparison of Extinct with Recent Elasmobranchs.

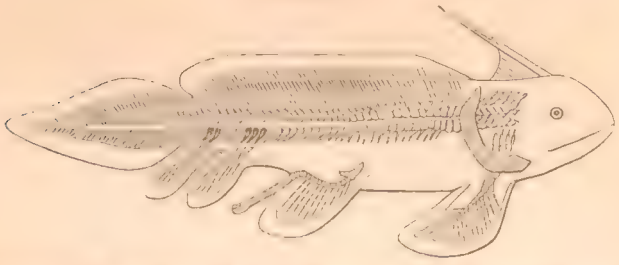
In discussing the bearing of the foregoing facts upon published schemes of classification of the Elasmobranchii, the first point to be considered is the validity of Prof. Cope's division of the subclass into the two orders Ichthyotomi and Selachii. If the characters of the dentition are of any systematic importance—and when genera of equivalent age are under comparison we believe they are—there can be no hesitation in associating the European later Palæozoic Pleuracanths with the skulls of the so-called *Didymodus*, Cope, from the Permian of Texas. It is thus possible, from the researches of Kner, Anton Fritsch, Traquair, and C. Brongniart, to take into consideration all the more prominent skeletal features of these primitive Elasmobranchs; and the study of nearly complete individuals from the Middle Coal-Measures of Commentry, France, has lately led M. Brongniart to attempt the restoration given in the accompanying fig. B[1].

As already remarked, we are inclined to believe, with Garman, that Cope's determination of cartilage-bones and membrane-bones in the skull of "*Didymodus*" was founded upon misconception; and

[1] *Op. cit.* p. 7, fig. 2.

it appears that this Permian fossil is a normal example of an amphistylic Elasmobranch skull. One feature in the appendicular skeleton, however, amply justifies the recognition of the Ichthyotomi as a distinct order, if appeal may be made to the analogy of the accepted classification of the bony hyostylic fishes. The possession

Fig. B.



Restoration of *Pleuracanthus gaudryi*. Coal-Measures, Commentry, France.
[After Charles Brongniart.]

of a pectoral archipterygium, of the type conceived by Gegenbaur, differentiates the Crossopterygii from the higher Ganoidei or Actinopterygii; and the same character separates the Ichthyotomi—though perhaps less widely—from the Selachii. The division of the pelvic girdle into two distinct halves is also a feature of significance; and the primitive character of the axial skeleton is worthy of note. According to Prof. Cope's latest proposition in regard to classification[1], the presence of a double series of interspinous cartilages will also enter into the ordinal definition[2]; but the characters of the median fins themselves, though in many respects primitive, cannot be quoted at present as of more than family rank.

Having thus eliminated the Ichthyotomi, and attempting no further division into suborders, on account of the slight character of available evidence, it remains to determine the possible classification of the Selachii into minor groups. As is well known, most zoologists divide these roughly into Sharks and Rays, in accordance with the lateral or inferior situation of the gill-clefts; Owen seems to overestimate a character of family value (the possession of dorsal fin-spines), and thus adds a third suborder; Gill adopts four divisions ("suborders") of Sharks, based upon the characters of the

[1] Amer. Nat. vol. xxi. (1887), p. 1015.

[2] This feature, however, has not been noted in *Cladoselache*; but the circumstance is perhaps explained by the imperfect preservation of known specimens.

skull; and Hasse four great suborders, based upon the condition of the axial skeleton.

With regard to the earliest of these classifications—the subdivision into Sharks and Rays—it must be regarded as approximately natural. For although some Sharks (*e. g.*, Scylliidæ) live upon the sea-bottom almost as constantly as the typical Rays, and although a certain amount of depression of the trunk and elongation of the slender tail naturally result from this circumstance, the pectoral fins never tend to enlarge, and the anal fin in no case disappears. On the other hand, even in such little-modified members of the Ray-series as the freely-swimming Pristidæ, the pectorals have so far enlarged as to grow forwards and turn the gill-clefts to the ventral aspect, while the anal fin is completely wanting; and every gradation can be traced from this type to the most modified Trygonidæ and Myliobatidæ.

At the same time, it must be remembered that, if the two subdivisions just mentioned are solely defined in the ordinary manner (*i. e.*, Sharks with lateral gill-clefts, and Rays with ventral gill-clefts), all survivors of the primitive families of the Ray-series will become included unnaturally among the Sharks. The Squatinidæ and Pristiophoridæ, for example, possess lateral gill-clefts, like Sharks; but the structure of the vertebræ, the partial growth forwards of the pectoral propterygium in *Squatina*, and several striking resemblances existing between *Pristiophorus* and *Pristis* and *Rhinobatus*, all point to the Squatinidæ and Pristiophoridæ as probably survivors of ancestral Rays. Moreover, the lowly family of Spinacidæ may be as justly placed in one group as in the other, so far as the situation of the gill-clefts is concerned; but from the circumstance that in some of the typical genera (e. g., *Acanthias*) considerable depression of the trunk is accompanied by a semi-ventral disposition of the clefts, while the anal fin is totally absent, it seems most philosophical to place the family provisionally with the less differentiated Rays.

External features, indeed, though suggesting a broad natural classification, do not suffice for precise subordinal diagnoses; and it is therefore necessary to take into account the distinctive features presented by the endoskeleton.

It might be supposed, at first sight, that the various modifications of the cranium and mandibular and hyoid arches would afford some satisfactory basis for the definition of subordinal groups; but Palæontology combines with modern zoological results to demon-

strate that no such points of broad systematic importance can be found.

Prof. Gill, for example, regards *Notidanus* as the type of a "suborder Opisthartheri," on account of the articulation of the pterygo-quadrate cartilage with the postorbital region of the cranium. According to Dr. Günther [1], however, the recently discovered *Chlamydoselache* falls into the same family as *Notidanus*; and, from any point of view, it would certainly be impossible to relegate the two genera just mentioned to groups more widely separated than families. Nevertheless, in *Chlamydoselache* there is no articulation between the pterygo-quadrate cartilage and the cranium; and the hyomandibular is as robust as in many types that would rank as modern. It ought also to be added that even in *Notidanus* itself the postorbital articulation does not arise until late in the history of the embryo [2]; while in the adults of such widely diverse genera as *Pleuracanthus* and *Synechodus* a precisely similar feature of specialization is to be observed.

Prof. Gill's "suborder Proarthri," typified by the existing *Cestracion*, would doubtless prove equally inconsistent with facts, if the relations of the mandibular and hyoid arches in its extinct allies could be ascertained. One Cretaceous genus (*Synechodus*), indeed, which cannot yet be separated from the Cestraciontidæ, exhibits the postorbital articulation of the pterygo-quadrate, exactly as in *Notidanus*.

Turning to the axial skeleton of the trunk, the elaborate researches of Prof. Carl Hasse have provided ample materials for discussion. As already explained, the Professor points out that the division of the Selachii into Sharks and Rays very nearly corresponds to a grouping suggested by the structure of the vertebral centra. In the Rays (Tectospondyli) a series of concentric laminæ surrounds the primitive double-cone of each vertebral centrum; in the majority of Sharks (Asterospondyli) the arrangement of the secondary laminæ is such as to impart a stellate aspect to transverse sections of the centra.

These features are distinctive to such an extent, that we venture to adopt the arrangement; and in this way it is possible to place the Pristiophoridæ and Squatinidæ in their apparently natural position in proximity to the Rays.

[1] "Report on the Deep-Sea Fishes" ('Challenger' Reports, Zool. vol. xxii. 1887), p. 2.

[2] T. H. Huxley, Proc. Zool. Soc. 1876, p. 44.

The latest results of Palæontology, however, do not justify other features in Prof. Hasse's classification, and absolutely negative some of the details.

Notidanus, for example, is made the type of a primitive division, the "Palæonotidani" or "Plagiostomi Diplospondyli," because the notochord is persistent, though intercalary cartilages are developed in the arches; but, as shown in the following Catalogue, the Liassic *Hybodus* possessed a persistent notochord, and even Prof. Hasse himself admits that other well-known features place this genus in immediate proximity to *Cestracion*.

Again, the Spinacidæ are regarded as representing a distinct division, the "Cyclospondyli," in which there are simple vertebral centra without any secondary calcifications. This is obviously a stage in advance of the "Palæonotidani," being halfway between these and either of the two higher groups, the Tectospondyli and Asterospondyli. But, like the Palæonotidani, the Sharks with an axial skeleton in this stage of development exhibit no other features widely separating them from the Selachians of the modern groups; and it appears to the present writer that there are known cyclospondylic members of each of these groups. As already remarked, the semiventral position of the gill-clefts in some Spinacidæ, and the absence of the anal fin in these fishes, are characters suggesting that they form the base of the Tectospondylic series. *Palæospinax* of the Lias, with its cyclospondylic vertebræ and distinct anal fin, scarcely differs from the Cretaceous asterospondylic *Synechodus*, except in the lower degree of calcification of the vertebræ; and the Liassic genus may therefore be placed with the Cestracionts in the Asterospondylic series.

In the sum-total of characters, indeed, the *degree* of development of the vertebral centra is of small importance; and the members of Hasse's "Palæonotidani" and "Cyclospondyli" may be variously distributed in the Tectospondyli and Asterospondyli, according as they approach well-defined types of the one group or the other. The acceleration of vertebral development, and the retardation of the same, are singular features apparently having little correspondence with the specialization or otherwise of characters still more likely to change. In *Chlamydoselache* the dentition is primitive, and in its close ally, *Notidanus*, the teeth attain extreme specialization; but the former has distinct cyclospondylic vertebræ, while the latter only exhibits slight calcifications sometimes in the caudal region. The Hybodont dentition persists in the notochordal *Hybo-*

dus, the cyclospondylic *Palæospinax*, and the asterospondylic *Synechodus*; and an extremely specialized dentition occurs in the existing cyclospondylic Spinacidæ, while in many of the asterospondylic Scylliidæ the teeth have quite a primitive aspect and disposition.

With regard to the minor grouping of the Selachii into families and genera, it is proposed to adopt the arrangement formulated by Dr. Günther in his Catalogue of 1870, for the recent forms; and the various extinct families and genera will be incorporated among these in such provisional positions as the available evidence may seem to justify. Except in the few instances in which complete skeletons are known, this evidence is necessarily very slight, and often admits of more than one interpretation; and no fossils are more difficult of satisfactory determination than scattered and isolated teeth.

The teeth, in fact, can often be only satisfactorily identified when something is known of their geological age and associations. There are Hybodont teeth in the Chalk which would be named *Orodus* if found in the Carboniferous; and some of the teeth of Rhætic age might well be mistaken for *Cladodus*. Lawley also doubtless had a prehensile tooth very similar to those of the Cochliodonts when he announced the discovery of *Helodus* in the Pliocene. But the evidence of associated remains demonstrates the improbability of all these identifications; and the same kind of evidence must be carefully taken into account when the minor matters of specific nomenclature are under discussion.

With regard to synonymy, under such circumstances there is scope for endless differences of opinion; and it seems necessary to accept as sufficiently defined each name applied to any part of a fish precisely and correctly described, which can afterwards be identified when satisfactory examples of that particular genus or species happen to be discovered. In recent Zoology it is possible to observe a stringent rule with reference to complete diagnoses; but in the Palæontology of the Vertebrata, if each investigator is permitted to decide whether a recognizably described fossil is sufficient to justify the retention or otherwise of the name originally proposed for it, generic and specific synonymy will multiply *ad infinitum*.

In the present state of Palæontology, it also seems advisable to employ generic and specific names in a somewhat extended sense; and the progress of research will doubtless lead to a further subdivision of many of the groupings now adopted. This Catalogue, however, can only be regarded as a provisional attempt to systematize

and arrange the ascertained facts of Elasmobranch Palæontology for convenience of reference; and the writer would claim indulgence for the numerous imperfections which further studies will soon reveal.

As the following pages demonstrate, the collection of the British Museum is now so extensive that actual specimens of nearly all the principal genera and species have been available for examination; and the present undertaking has been all the more facilitated by the orderly arrangement of this collection, due to the long-continued labours of Mr. William Davies. To this gentleman the writer is under the greatest obligation, not only for continual advice and the benefit of his wide experience, but also for reading the whole of the proofs; and both to him and to many other friends cordial thanks are respectfully tendered. To Dr. Günther the writer is indebted for help in regard to modern Selachians; to Dr. R. H. Traquair and Mr. James W. Davis, in regard to Palæozoic genera. Mr. John Ward, of Longton, has freely placed his unique series of Coal-Measure fishes at the writer's disposal; and Mr. Henry Willett, of Brighton, has extended similar favours in permitting the use of his fine collection from the Sussex Chalk. Among fellow-workers in Palæichthyology on the Continent, Prof. K. A. von Zittel, of Munich, Prof. W. Dames, of Berlin, and Dr. Anton Fritsch, of Prague, have rendered much assistance; and wherever the writer has sought information, either in Britain or abroad, it has invariably been most liberally accorded.

ARTHUR SMITH WOODWARD.

Geological Department,
March 8th, 1889.

List of Collections.

In the following Catalogue all Donations are acknowledged in full, with the Donor's name and the date, whether the specimens form part of a large series or were separately presented. In the case of collections acquired by purchase, only the name of the founder of each of these is mentioned, and detailed particulars are given in the list below:—

Baugh Collection.—A series of fish-remains, chiefly teeth and fin-

spines from the Carboniferous Limestone of Shropshire, purchased from the executors of the late Mr. T. Baugh, of Bewdley, 1870.

Miss Baker's Collection.—A miscellaneous collection from Northamptonshire, purchased from Miss Baker, of Northampton, about 1843.

Bayfield Collection.—Fossil fishes and reptiles, chiefly from the Upper Chalk of Norfolk, purchased from Mr. T. G. Bayfield, of Norwich, 1878.

Bean Collection.—Miscellaneous fossils, chiefly Oolitic, from Yorkshire, purchased from Mr. William Bean, of Scarborough, 1859.

Bowerbank Collection.—This collection comprises many remains of fishes from the English Cretaceous and Eocene, and was purchased in 1865 from the late Dr. J. S. Bowerbank, F.R.S., of Highbury.

Braun Collection.—Vertebrate fossils from the Continental Trias, purchased from Dr. Alexander Braun, about 1836.

Byne Collection.—Miscellaneous fossils from the Jurassic of Gloucestershire, purchased from Mr. Byne, before 1845.

Caleb Evans Collection.—This collection comprises several fossil fish-remains from the English Eocene and Cretaceous, and was purchased from the executors of the late Mr. Caleb Evans, 1888.

Capron Collection.—A fine series of English Chalk fossils, purchased from Mr. J. Rand Capron, of Guildford, 1879.

Cunnington Collection.—This collection comprises numerous remains of fossil fishes, chiefly from Wiltshire, and the main portion was purchased from Mr. William Cunnington, of Devizes, in 1875, though earlier instalments were received in 1849, 1859, and 1861.

Daniels Collection.—Fossils from the English Chalk and Eocene, purchased from the executors of Mr. H. Daniels, about 1860.

Dawson Collection.—Vertebrate fossils from the Wealden of the neighbourhood of Hastings, collected by Mr. Charles Dawson, of St. Leonards. The first portion of the collection was purchased in 1884, since which date additions have been continually made to the series.

Dixon Collection.—A series of specimens, mainly from the Tertiaries and Chalk of the South of England, purchased in 1851 from the executors of the late Mr. Frederic Dixon, of Worthing.

Edwards Collection.—This collection comprises numerous remains of fossil fishes from the Eocene of Hampshire, and was purchased from Mr. F. E. Edwards, in 1867 and 1873.

Egerton Collection.—A very extensive collection of fossil fishes,

purchased from the executors of the late Sir Philip de Malpas Grey Egerton, Bart., M.P., F.R.S. (Trustee Brit. Mus.), in 1882.

Enniskillen Collection.—A very extensive collection of fossil fishes, purchased from the Right Hon. the Earl of Enniskillen, F.R.S., in 1882.

Fox Collection.—An important series of vertebrate fossils, chiefly reptilian, from the Wealden of the Isle of Wight, purchased, in 1882, from the executors of the late Rev. W. Fox, of Brixton, Isle of Wight.

Gardner Collection.—Miscellaneous specimens from the English Cretaceous and Eocene, collected by Mr. J. Starkie Gardner, and purchased from that gentleman in 1876, 1879, and 1881.

Gilbertson Collection.—Carboniferous fossils, chiefly from Carboniferous Limestone and Yoredale Rocks of Yorkshire and Lancashire, collected by Mr. William Gilbertson, of Preston, and purchased in 1841.

Häberlein Collection.—Fossils from the Lithographic Stone of Bavaria, purchased from Dr. Carl Häberlein, of Pappenheim, in 1862.

Harford Collection.—A miscellaneous collection, comprising numerous remains of fossil fishes from the Chalk of Kent and the English Tertiaries, purchased from Mr. F. Harford, of South Norwood, in 1888.

Harris Collection.—Fossils from the Kentish Chalk, collected by the late Mr. Harris, of Charing, purchased in 1881 from Prof. Rupert Jones, F.R.S.

Horne Collection.—Fossil teeth of Elasmobranch fishes from the Yoredale Rocks of Wensleydale, Yorkshire, purchased in 1885 from Mr. William Horne, of Leyburn.

Johnson Collection.—Fossils from the English Lias, collected by Dr. J. R. Johnson, of Hot Wells, Bristol, and purchased in 1845.

Mantell Collection.—A large and important collection, mainly comprising specimens from the Cretaceous of the South of England, acquired in two portions. The first portion was purchased in 1838 from the late Dr. Gideon A. Mantell, F.R.S., and the second from his executors in 1853.

Sharp Collection.—A series of specimens chiefly from the Jurassic of Northamptonshire, purchased in 1876 from Mr. Samuel Sharp, of Dallington Hall, Northamptonshire.

Sloane Collection.—Purchased from the executors of Sir Hans Sloane, Bart., F.R.S., of Chelsea, in 1753.

Mrs. Smith's Collection.—Fossil fishes and reptiles from the Chalk of Kent, collected by the late Mrs. Smith, of Tunbridge Wells, and purchased in 1878 from her daughter Mrs. Bishop.

Taylor Collection.—Chalk fossils purchased from Mr. H. W. Taylor.

Tesson Collection.—A series of specimens from the Jurassic of Normandy, purchased in 1857 from the late Mons. Tesson, of Caen.

Toulmin-Smith Collection.—Chalk fossils purchased in 1869 from the widow of the late Mr. J. Toulmin Smith, of Highgate.

Van Breda Collection.—This collection comprises numerous remains of fossil fishes, from the Upper Cretaceous of Maastricht, the Eocene of Aix-en-Provence, and the Miocene of Oeningen, Switzerland, and was purchased in 1871 from the executors of the late Professor Van Breda, of Haarlem [1].

Weaver-Jones Collection.—Fossil teeth and fin-spines of Elasmobranch fishes from the Carboniferous Limestone of Shropshire, purchased in 1880 from the executors of the late Mr. Weaver Jones, of Cleobury Mortimer.

Wetherell Collection.—A miscellaneous series of specimens from the English Chalk and Eocene, purchased, through the late Mr. J. Tennant, from the late Mr. N. T. Wetherell, of Highgate, in 1871.

Wigham Collection.—Norfolk fossils collected by Mr. Wigham, of Norwich, purchased in 1859 from Mr. T. G. Bayfield, of the same city.

Wilson Collection.—A series of teeth of Elasmobranch fishes, chiefly from the Upper Carboniferous Limestone of Ticknall, near Melbourne, South Derbyshire, purchased in 1887 from Mr. Edward Wilson, of Bristol.

Almost all the Cretaceous fishes from Mount Lebanon mentioned in this Catalogue were collected by the Rev. Professor E. R. Lewis, M.A., late of the Syrian Protestant College, Beirut, and were obtained by purchase, in several series, from Mr. R. Damon, of Weymouth.

Bequests.

Cowderoy Bequest.—By Miss Cowderoy, about 1854.

Cracherode Bequest.—By the Rev. C. M. Cracherode, 1799.

Trevelyan Bequest.—By Sir W. C. Trevelyan, Bart., 1879.

[1] Professor van Breda was son-in-law to Dr. Petrus Camper, the celebrated Dutch Anatomist, from whom he inherited much of his collection. Many of the Oeningen specimens were also collected by Prof. Oswald Heer, of Zurich.

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CATALOGUE

OF

FOSSIL FISHES.

Class **PISCES.**

Subclass I. ELASMOBRANCHII.

Skeleton cartilaginous, membrane-bones absent (? except rarely, ill-defined). Mandibular suspensorium articulated with the cranium; gill-clefts separated, without external cover. Exoskeleton, when present, structurally identical with the teeth. In the living forms —optic nerves not decussating, bulbus arteriosus of the heart with three series of valves, intestine with a spiral valve, and ovaries with few large ova.

Order I. ICHTHYOTOMI.

Endoskeletal cartilage permeated throughout with granular calcifications. Notochord rarely or never constricted; calcifications of the sheath arrested at the most primitive "rhachitomous" stage, except in the caudal region. Neural and hæmal arches and spines long and slender; no intercalary cartilages. Pectoral fins with long segmented axis ("archipterygial").

Family PLEURACANTHIDÆ.

Body slender, but slightly depressed; mouth terminal; tail diphycercal. Dorsal fin elongate, low, continuous along the back from a point shortly behind the head; slender interneural cartilages more numerous than the neural spines. Pectoral fin with biserial arrangement of cartilaginous rays.

Genus **PLEURACANTHUS**, Agassiz.

[Poiss. Foss. vol. iii. 1837, p. 66.]

Syn. *Diplodus*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 204.
Orthacanthus, L. Agassiz, *tom. cit.* 1843, pl. 45. figs. 7–9.
Xenacanthus, E. Beyrich, Monatsb. Verh. k. Preuss. Akad. Wiss. 1848, p. 24.
Triodus, Jordan, Neues Jahrb. 1849, p. 843.
Compsacanthus, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. 1856, p. 100.
Dittodus, R. Owen, Trans. Odont. Soc. vol. v. 1867, p. 325.
Aganodus, R. Owen, *tom. cit.* p. 359.
Ochlodus, R. Owen, *tom. cit.* p. 346.
Pternodus, R. Owen, *tom. cit.* p. 363.
Thrinacodus, St. John & Worthen, Pal. Illinois, vol. vi. 1875, p. 289.
Lophacanthus, T. Stock, Ann. Mag. Nat. Hist. [5] vol. v. 1880, p. 217.
Anodontacanthus, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. 1881, p. 427.
Didymodus, E. D. Cope, Proc. Acad. Nat. Sci. Philad. 1883, p. 108.

Body probably destitute of shagreen; a long barbed spine, with two series of denticles, placed dorsally immediately behind the head. Teeth with thick depressed root, the crown consisting of two principal divergent cones, generally of unequal size, with a more or less minute intermediate denticle, and often a round flat-topped boss ("button") behind.

The generic identity of the fishes bearing the spines named *Pleuracanthus* and *Xenacanthus*, and the teeth named *Diplodus*, was first pointed out by Egerton [1]. *Triodus* was also referred to the same genus by Schnur [2], and *Orthacanthus* by J. W. Davis [3]. Zittel has already remarked [4] upon the probable identity of *Compsacanthus* with the so-called *Orthacanthus*: and Traquair has determined [5] the identity of *Anodontacanthus*, in part, with the spines of the present genus. The name *Thrinacodus* was given by St. John and Worthen to teeth differing from those of "*Diplodus*" in the absence of a "button"—a character apparently inconstant, as noted by Cope [6]. *Dittodus*,

[1] Ann. Mag. Nat. Hist. [2] vol. xx. (1857), p. 423.
[2] Zeitschr. deutsch. geol. Gesell. vol. viii. (1856), p. 542.
[3] Quart. Journ. Geol. Soc. vol. xxxvi. (1880), p. 331.
[4] Handb. Palæont. vol. iii. pt. i. (1887), p. 90.
[5] Geol. Mag. [3] vol. v. (1888), p. 101.
[6] Proc. Amer. Phil. Soc. 1884, p. 589.

Aganodus, *Ochlodus*, and *Pteinodus*, according to Hancock and Atthey [1], are supposed genera founded upon fragments of the teeth named *Diplodus*. *Didymodus* must also be included here until satisfactory evidence as to its true position is obtained; the distinctive features noted by Prof. Cope [2] are most probably due to the perfection of the Texas fossils as compared with those of Europe.

The teeth of most species of *Pleuracanthus* cannot yet be correlated with the spines, and it is thus necessary still to retain the provisional name of *Diplodus*.

I. *Species already known with much completeness.*

Pleuracanthus decheni (Goldfuss).

1847. *Orthacanthus decheni*, Goldfuss, Neues Jahrb. p. 404.
1847. *Orthacanthus decheni*, Goldfuss, Beitr. vorw. Fauna Steink. p. 23, pl. v. figs. 9–11.
1848. *Xenacanthus decheni*, E. Beyrich, Monatsb. Verh. k. Preuss. Akad. Wiss. p. 24.
1849. *Triodus sessilis*, Jordan, Neues Jahrb. p. 843.
1851–56. *Xenacanthus decheni*, F. Roemer, in Bronn's Leth. geogn. 3rd ed. vol. i. p. 693, pl. ix[4]. fig. 15.
1856. *Xenacanthus decheni*, Schnur, Zeitschr. deutsch. geol. Ges. vol. viii. p. 542.
1857. *Xenacanthus decheni*, F. Roemer, Zeitschr. deutsch. geol. Ges. vol. ix. p. 60.
1857. *Pleuracanthus decheni*, Sir P. Egerton, Ann. Mag. Nat. Hist. [2] vol. xx. p. 423.
1861. *Xenacanthus decheni*, H. B. Geinitz, Dyas, p. 23, pl. xxiii. fig. 1.
1867. *Xenacanthus decheni*, R. Kner, Sitzungsb. k. Akad. Wiss. Wien, vol. lv. pt. i. p. 540, pls. i.–x.[3]
1868. *Xenacanthus decheni*, C. Lutken, Geol. Mag. vol. v. p. 376.
1880. *Pleuracanthus decheni*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. p. 321.
1883. *Pleuracanthus* and *Xenacanthus*, C. Hasse, Neues Jahrb. vol. ii. p. 65.

Type. Imperfectly preserved skeleton; Berlin Museum.

A comparatively small species, the barbed spine not attaining a greater length than about 0·11 m. in the adult. Spine much compressed and flattened antero-posteriorly; denticles thick, pointed but not hooked, placed in very close series upon each lateral margin. Principal cones of the dental crown compressed, smooth or slightly striated, with a slender intermediate denticle.

[1] Nat. Hist. Trans. Northumb. & Durham, vol. iii. p. 113.
[2] See detailed description in Proc. Amer. Phil. Soc. 1884, pp. 572–590, plate.
[3] This is the most exhaustive account of the genus and species yet published.

It is uncertain at present whether all the specimens commonly referred to this species are truly identical, but we venture to adopt the provisional arrangement of Kner. Many of the differences noted between the various fossils are undoubtedly due to accident in preservation; moreover, it appears that errors in description must also be taken into account[1].

Form. & Loc. Lower Permian (Rothliegendes): Bohemia, Silesia, Rhenish Prussia.

19665–6. Two imperfect skeletons, one showing a portion of the spine in position, the other a part of the pectoral fin; Ruppersdorf, Bohemia. The first of these specimens exhibits distinct calcifications in the sheath of the notochord, and is referred to by Hasse, Neues Jahrb. 1883, vol. ii. p. 65. *Purchased*, 1845.

35015. Imperfect skeleton, with the impression of the complete spine and a well-preserved fragment of this defence (Pl. VI. fig. 1); Ruppersdorf. This specimen exhibits complete broad ring-like calcifications in the sheath of the notochord in the caudal region, and is noticed by Hasse, *loc. cit.* *Purchased*, 1860.

P. 1729. Crushed skull and pectoral arch, with the spine in position; Ruppersdorf. *Egerton Coll.*

P. 3182. A similar, but smaller specimen; Ruppersdorf. *Enniskillen Coll.*

38154. Specimen 0·325 m. in length, showing imperfect teeth and spine, a portion of the pectoral arch, the vertebral column, and impressions of the dorsal and pectoral fins; Braunau, Bohemia. In the abdominal region there appear to be calcifications in the sheath of the notochord. The acutely-lobate character of the pectoral fin is well shown by the preservation of a fringe of horny fin-rays, such as are also present in the dorsal fin.

Presented by Sir Roderick I. Murchison, K.C.B., 1864.

P. 3183. Portion of axial skeleton of the trunk, with median fin, doubtfully referred to this genus and species: Braunau. The expansion of the bases of the neural and hæmal arches is well shown. *Enniskillen Coll.*

[1] *E. g.* see Kner's remarks upon the spine described by Goldfuss, *loc. cit.* p. 550.

P. 1728. Remains of the head and anterior portion of the trunk; Klein Neundorf, near Löwenberg, Silesia. A few teeth are shown, having the coronal cusps smooth.
Egerton Coll.

P. 3179. A similar specimen, exhibiting more of the trunk, but no teeth; Klein Neundorf. *Enniskillen Coll.*

P. 3180. Head and anterior portion of the trunk, upper and lateral aspect; Klein Neundorf. The cartilages of the appendicular skeleton and the axial skeleton of the trunk exhibit distinct nodular calcifications, having thus a "beaded" appearance. *Enniskillen Coll.*

P. 3181. Portion of trunk, showing imperfect pelvic girdle and fins; Klein Neundorf. Triangular calcifications are distinguishable, and may be either the bases of the arches or elements in the sheath of the notochord. *Enniskillen Coll.*

40046. Portion of trunk, preserved in counterpart, showing the supporting cartilages of the dorsal fin more numerous than the neural spines; in nodule from Lebach, near Saarbrücken, Rhenish Prussia. The bases of the neural and hæmal arches exhibit triangular expansions, and no distinct calcifications are observed in the sheath of the notochord. *Purchased*, 1866.

40047. Head and anterior portion of the trunk, preserved in counterpart; Lebach. The coronal cusps of the teeth are smooth. *Purchased*, 1866.

II. *Species founded upon spines.*

Pleuracanthus lævissimus, Agassiz.

1837. *Pleuracanthus lævissimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 66. pl. 45. figs. 4, 5.
1843. *Pleuracanthus planus*, L. Agassiz, *tom. cit.* p. 177 (name only).
1873. *Pleuracanthus lævissimus*, T. P. Barkas, Coal Meas. Palæont. p. 17, pl. i. figs. 14–16.
1875. *Pleuracanthus lævissimus*, J. Ward, [Proc.] N. Staffs. Nat. Field-Club, p. 225.
1880. *Compsacanthus major*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. p. 62, woodc. fig. 2.
1880. *Pleuracanthus lævissimus*, J. W. Davis, *loc. cit.* vol. xxxvi. p. 325.
1880. *Pleuracanthus erectus*, J. W. Davis, *loc. cit.* vol. xxxvi. p. 326, woodc. fig. 2.

1880. *Pleuracanthus pulchellus*, J. W. Davis, *loc. cit.* vol. xxxvi. p. 327, pl. xii. fig. 2.

1881. *Anodontacanthus fastigiatus*, J. W. Davis, *loc. cit.* vol. xxxvii. p. 428, pl. xxii. fig. 12.

(?) 1881. *Anodontacanthus obtusus*, J. W. Davis, *loc. cit.* vol. xxxvii. p. 428, pl. xxii. fig. 11.

1888. *Pleuracanthus lævissimus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 101.

Type. Spine from S. Staffordshire Coal-Measures.

Spine of adult fish attaining a maximum length of about 0·3 m., straight, compressed antero-posteriorly throughout the greater portion of its length, but with a median longitudinal angulation towards the distal extremity. Denticles placed laterally, of moderate size, very sharply pointed and reflexed.

P. erectus, Davis, is evidently founded upon an abraded portion of a spine pertaining to this species. *P. planus*, Agassiz, is identical with *P. pulchellus*, Davis, and as there is no feature except size separating it from the typical *P. lævissimus*, while intermediate forms in this respect are noted below, it cannot be regarded as distinct.

Form. & Loc. Coal-Measures: Midlothian, Lanarkshire, Scotland; Northumberland, Yorkshire, Staffordshire, England.

41115. Crushed and abraded spine, 8 inches (0·23 m.) in length; Dalkeith, Edinburgh. The worn extremity shows the characters of the so-called *P. erectus*. *Purchased*, 1868.

33226–7, 36175. Fragments of spines; Dalkeith. *Purchased*, 1857, 1862.

P. 3027, P. 3027 a. One spine 0·255 m. in length, and the terminal half of a smaller example; Dalkeith. *Enniskillen Coll.*

P. 3178, P. 3178 a, P. 3178 b. Three incomplete large specimens; Dalkeith. The first spine is 0·35 m. in length; in the second the rows of lateral denticles are more posteriorly situated than ordinarily. *Enniskillen Coll.*

P. 3028. A much abraded imperfect spine; Dalkeith. *Enniskillen Coll.*

P. 1730. Fragments of spines, probably all of this species; Caudenfoot, near Dalkeith. One is remarkable for the small size of the proximal lateral denticles. *Egerton Coll.*

P. 1730 a. Portion of small spine having the lateral denticles placed far posteriorly, as in No. P. 3178 *a*; Caudenfoot. *Egerton Coll.*

P. 1732. Distal two-thirds of small spine: locality unknown. This specimen shows several of the lateral denticles detached from the spine. *Egerton Coll.*

42035. Portion of spine, probably of the same type as Nos. P. 1730 *a* and P. 3178 *a*; Airdrie, Lanarkshire. *Purchased*, 1870.

21423 a. Small spine, doubtfully assigned to young of this species; Carluke, Lanarkshire. *Purchased*, 1847.

P. 1181. Portions of two medium-sized spines, and the impressions of part of two others; Middle Coal-Measures, Tingley, Yorkshire. *Presented by the Earl of Enniskillen*, 1882.

P. 1183. Base of a large specimen; Tingley.
Presented by the Earl of Enniskillen, 1882.

P. 1179. Two abraded fragments, named *P. crotus*, J. W. Davis; Tingley. *Presented by the Earl of Enniskillen*, 1882.

P. 531. Specimen referred to by Agassiz, *loc. cit.*, under the name of *P. planus*; Leeds, Yorkshire. *Egerton Coll.*

P. 1178. Two specimens of the so-called *P. pulchellus*, J. W. Davis; Tingley. *Presented by the Earl of Enniskillen*, 1882.

P. 5170. Somewhat larger and much abraded, though similar specimen; Longton, North Staffordshire. *Purchased*, 1885.

P. 1733. Two small spines, one much abraded, probably young of this species; Longton. *Egerton Coll.*

Pleuracanthus robustus, Davis[1].

1880. *Pleuracanthus robustus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. p. 330, pl. xii. fig. 5.

Type. Spine; Davis Collection.

Spine (so far as known) not attaining a greater length than 0·13 m., almost straight, round or triangular in section, flattened posteriorly. Denticles large, robust, sharply pointed, arranged in series along each margin of the posterior flattened area.

Form. & Loc. Middle Coal-Measures: Yorkshire.

P. 1177, P. 1180. Five incomplete specimens; Tingley.
Presented by the Earl of Enniskillen, 1882.

21423. Four small spines, doubtfully associated with this species; Coal-Measures, Carluke, Lanarkshire. *Purchased*, 1847.

[1] It is not improbable that the so-called *Compsacanthus triangularis* is founded upon an abraded spine of this species. J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. (1880) p. 62, woodc.).

Pleuracanthus arcuatus, Newberry.

1856. *Pleuracanthus arcuatus*, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. p. 100.

1873. *Orthacanthus arcuatus*, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. i. pt. ii. p. 332, pl. xl. fig. 4.

Type. Spine.

Spine (so far as known) not more than 0·15 m. in length, slightly arched, rounded in section, but flattened posteriorly. Denticles small, but very robust, numerous, and closely arranged in series along each margin of the posterior flattened area.

Form. & Loc. Coal-Measures: Ohio, U.S.A.

P. 1734. Impression of spine in shale; Linton. *Egerton Coll.*

P. 5443. A similar fossil; Linton. *Enniskillen Coll.*

Pleuracanthus cylindricus (Agassiz).

1843. *Orthacanthus cylindricus*, L. Agassiz, Poiss. Foss. vol. iii. pl. 45. figs. 7-9.

1873. *Orthacanthus*, T. P. Barkas, Coal Meas. Palæont. p. 20, figs. 39-42.

1875. *Orthacanthus cylindricus*, J. Ward, [Proc.] North Staffs. Nat. Field-Club, p. 217.

(?) 1879. *Phricacanthus biserialis*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxv. p. 186, pl. x. figs. 16, 17.

1880. *Lophacanthus taylori*, T. Stock, Ann. Mag. Nat. Hist. [5] vol. v. p. 217, woodc.

1880. *Pleuracanthus cylindricus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. p. 331, woodc.

(?) 1881. *Anodontacanthus acutus*, J. W. Davis, *loc. cit.* vol. xxxvii. p. 428, pl. xxii. fig. 10.

1888. *Pleuracanthus* (*Orthacanthus*) *cylindricus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 101.

Type. Spine.

Spine of adult fish attaining a maximum length of about 0·5 m., straight, or slightly arched towards the apex, and cylindrical in section. Denticles robust, pointed, arranged in double series upon the posterior aspect.

Form. & Loc. Coal-Measures: Scotch Coalfield; Northumberland, Yorkshire, Lancashire, Staffordshire.

P. 1725. Spine, 16 inches (0·4 m.) in length; probably from Dalkeith, near Edinburgh. *Egerton Coll.*

P. 3175. An equally large specimen, more abraded; Dalkeith. *Enniskillen Coll.*

P. 3176. Abraded fragment of small spine; Low-moor, Yorkshire. *Enniskillen Coll.*

P. 3177. Small, much-abraded spine: Bassy-mine Ironstone, Longton, N. Staffordshire. *Enniskillen Coll.*

P. 244, P. 5447. Fragments of large spines; New Ironstone, Fenton, N. Staffordshire. *Purchased*, 1880, 1886.

The following species have also been founded upon detached spines, but there are no examples in the Collection :—

Pleuracanthus alatus, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. (1880), p. 329, pl. xii. fig. 4.—Middle Coal-Measures; Tingley, Yorkshire.

Pleuracanthus altecnidentatus, J. W. Davis, *tom. cit.* p. 328, pl. xii. fig. 3.—Coal-Measures; near Leeds, Yorkshire.

Pleuracanthus biserialis, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. 1856, p. 100.—Coal-Measures; Ohio.

Pleuracanthus bohemicus: *Orthacanthus bohemicus*, A. Fritsch, Sitzungsb. königl. böhm. Gesell. Wiss. 1877, p. 47; *loc. cit.* 1879, p. 189; K. A. Zittel, Handb. Palæont. vol. iii. pt. i. (1887), p. 90, woodc. fig. 101.—Lower Permian; Bohemia.

Pleuracanthus denticulatus, J. W. Davis, *tom. cit.* p. 334, pl. xii. fig. 7.—Lower Coal-Measures; near Halifax, Yorkshire.

Pleuracanthus dilatatus, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. 1856, p. 100.—Coal-Measures; Ohio.

Pleuracanthus elegans, R. H. Traquair, Geol. Mag. [2] vol. viii. (1881), p. 36.—L. Carboniferous; Borough Lee, Edinburgh.

Pleuracanthus frossardi, A. Gaudry, Nouv. Archiv. Mus. vol. iii. (1867), p. 39, pl. iii. fig. 5.—Middle Permian; Autun, Saône-et-Loire, France.

Pleuracanthus gaudryi, C. Brongniart, Comptes Rend., vol. cvi. (1888), p. 1240.—Coal-Measures; Commentry, Allier.

Pleuracanthus gracilimus, R. H. Traquair, Geol. Mag. [2] vol. ix. (1881), p. 540.—Lower Carboniferous; Borough Lee, near Edinburgh.

Pleuracanthus horridulus, R. H. Traquair, *tom. cit.* p. 541.—Lower Carboniferous; Borough Lee, near Edinburgh.

Pleuracanthus laevis: *Compsacanthus laevis*, J. S. Newberry, Proc. Acad. Philad. 1856, p. 100, and Rep. Geol. Surv. Ohio, vol. i. pt. ii. (1873), p. 372, pl. xl. fig. 5; (?) *Orthacanthus gracilis*, id. *op. cit.* vol. ii. pt. ii. p. 56, pl. lix. fig. 7.—Coal-Measures; Ohio.

Pleuracanthus quadriseriatus: *Orthacanthus quadriseriatus*, E. D. Cope, Proc. Amer. Phil. Soc. 1877, p. 192.—Permian; Eastern Illinois.

Pleuracanthus tenuis, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvi. (1880), p. 327, pl. xii. fig. 1.—Lower Coal-Measures; near Halifax, Yorkshire.

Pleuracanthus wardi, J. W. Davis, *tom. cit.* p. 334, pl. xii. fig. 6. —Coal-Measures (Ragmine); Fenton, N. Staffordshire.

Two small spines, from the Devonian of Russia, have been erroneously referred to this genus—the one named *P. tuberculatus* (E. d'Eichwald, Bull. Soc. Imp. Nat. Moscou, vol. xix. 1846, no. iv. p. 293, pl. x. figs. 8, 9), the other *P. porosus* (E. d'Eichwald, Lethæa Rossica, vol. i. (1860), p. 1607, pl. lv. fig. 8).

III. *Species founded upon teeth.*

Diplodus gibbosus, Agassiz.

1841. *Diplodus gibbosus*, E. W. Binney, Trans. Manchester Geol. Soc. vol. i. p. 169, pl. v. figs. 17, 18 (name and figure only).

1843. *Diplodus gibbosus*, L. Agassiz, Poiss. Foss. vol. iii. p. 204, pl. 22 *b*. fig. 1 (*non* figs. 2–5) (B.M. Coll.).

(?) 1843. *Diplodus minutus*, L. Agassiz, *tom. cit.* p. 205, pl. 22 *b*. figs. 6–8.

1851. *Diplodus gibbosus*, W. C. Williamson, Phil. Trans. p. 680.

1867. *Dittodus parallelus*, R. Owen, Trans. Odontol. Soc. vol. v. p. 325, pl. i.

1867. *Dittodus divergens*, R. Owen, *tom. cit.* p. 334, pl. ii.

1867. *Ochlodus crassus*, R. Owen, *tom. cit.* p. 346, pl. v.

1867. *Aganodus apicalis*, R. Owen, *tom. cit.* p. 359, pl. ix.

1867. *Aganodus undatus*, R. Owen, *tom. cit.* p. 362, pl. x.

1867. *Pternodus productus*, R. Owen, *tom. cit.* p. 363, pl. xi.

1870. *Diplodus gibbosus*, A. Hancock & T. Atthey, Nat. Hist. Trans. Northumberland and Durham, vol. iii. p. 111.

1875. *Pleuracanthus* (*Diplodus*) *gibbosus*, J. Ward, [Proc.] North Staffs. Nat. Field-Club, p. 224.

Type. Detached tooth; British Museum (P. 497).

Teeth having principal cones of the crown divergent, compressed, with lateral carinæ, sometimes delicately serrated; median denticle short, compressed, and slender, and posterior "button" prominent.

Form. & Loc. Coal-Measures: Northumberland, Lancashire, Staffordshire.

P. 497. Type specimen; Silverdale, S. Staffordshire. *Egerton Coll.*

P. 1724. Fragments of teeth; Silverdale. *Egerton Coll.*

46294. Eleven teeth; Longton, N. Staffordshire.
Presented by John Ward, Esq., 1874.

46029. Three teeth of a small variety, with very divergent principal cusps, doubtfully of this species; Longton.
Presented by John Ward, Esq., 1874.

P. 1725. Two teeth from Deep-mine shale; Longton. *Egerton Coll.*

P. 3025. Thirteen teeth, one of unusual size, with very broad compressed principal cusps; Longton. *Enniskillen Coll.*

P. 5161. Large tooth: Longton. *Purchased*, 1885.

P. 5448. Tooth, associated with dermal prickles: near Manchester.

P. 1726. Imperfect teeth; Leeds. *Egerton Coll.*

41205 a. Small tooth; Newcastle-upon-Tyne.
Presented by T. P. Barkas, Esq., 1868.

Diplodus tenuis, sp. nov.

1843. *Diplodus gibbosus*, L. Agassiz, Poiss. Foss. vol. iii. p. 204, pl. 22*b*, figs. 2–5.

1861. *Pleuracanthus* (*Xenacanthus*) *gibbosus*, J. W. Salter, Iron Ores Gt. Britain—South Wales (Mem. Geol. Surv.), p. 224, pl. i. fig. 10.

(?) 1873. *Diplodus gibbosus* and *D. plodus* sp., T. P. Barkas, Coal Meas. Palæont. p. 16, pl. i. figs. 6–13.

1874. *Diplodus*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. ii. p. 346, figs. i.–v.

Type. Detached teeth, Pl. VI. figs. 2–4: British Museum.

The two principal cones of the dental crown slender, round in section, slightly compressed and divergent towards the extremities; intermediate denticle very long and slender.

Form. & Loc. Coal-Measures: Scotch Coalfield: Northumberland, Yorkshire, Lancashire, Staffordshire; South Wales.

P. 3026. Remains of associated teeth. One, exhibiting the anterior aspect, is shown, of twice nat. size, in Pl. VI. fig. 2; another, side view, in fig. 4; Carluke. *Enniskillen Coll.*

20695–6. Four pieces of shale with numerous teeth; one, exhibiting the posterior aspect, is shown, of twice nat. size, in Pl. VI. fig. 3; Carluke, Lanarkshire. *Purchased*, 1847.

21422. Portion of a similar tooth; Carluke. *Purchased*, 1847.

21975. Four teeth; Carluke. *Purchased*, 1848.

P. 5444. Associated teeth; Dalkeith, Edinburgh. *Enniskillen Coll.*

41635. Six pieces of shale with teeth and fragments of cartilage, and scattered minute pointed tubercles, suggestive of a sparse shagreen; Newcastle-upon-Tyne.
Presented by T. P. Barkas, Esq., 1869.

P. 1182. Associated group of teeth, with fragments of cartilage; Middle Coal-Measures, Tingley, Yorkshire.
Presented by the Earl of Enniskillen, 1882.

P. 1725 a. Tooth; Decpmine shale; Longton. *Egerton Coll.*

Diplodus parvulus, Traquair.

1881. *Diplodus parvulus*, R. H. Traquair, Geol. Mag. [2] vol. viii. p. 36.

Type. Detached teeth; Traquair Collection.

Teeth of comparatively small size. Principal cones slightly compressed, with sharp edges; coronal surface smooth; median denticle in the form of a blunt lobulated boss; posterior "button" present.

Form. & Loc. Middle Carboniferous Limestone: Edinburgh.

P. 4495. Six specimens; Blackband Ironstone, Borough Lee, near Edinburgh. Two of the teeth are shown, of the natural size, in Pl. VI. figs. 5, 6, both showing the anterior aspect. *Presented by R. H. Traquair, Esq., M.D.*, 1884.

P. 2295. Similar small tooth: Loanhead. *Purchased*, 1882.

Diplodus latus, Newberry.

1856. *Diplodus latus*, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. p. 99.

1866. *Diplodus latus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 59, pl. iv. fig. 1.

1873. *Diplodus latus*, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. i. pt. ii. p. 336.

1875. *Diplodus latus*, J. S. Newberry, *op. cit.* vol. ii. pt. ii. p. 44, pl. lviii. fig. 1.

Type. Detached tooth.

A comparatively large species. Principal cusps of dental crown extremely compressed and broad, with strongly serrated edges; anterior median denticle small; posterior "button" prominent. Anterior border of root produced downwards into an acute point.

Form. & Loc. Coal-Measures: Illinois, Ohio, Indiana, U.S.A.

P. 1720. Two imperfect teeth; Linton, Ohio. *Egerton Coll.*

P. 3030. Imperfect tooth: Linton. *Enniskillen Coll.*

P. 3031. Portions of three teeth; Posey Co., Indiana. *Enniskillen Coll.*

Diplodus compressus, Newberry.

1856. *Diplodus compressus*, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. p. 99.

1866. *Diplodus compressus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 60, pl. iv. fig. 2.

1870. *Diplodus compressus*, O. St. John, Proc. Amer. Phil. Soc. vol. xi. p. 432.
1872. *Diplodus compressus*, O. St. John, in Hayden's Final Rep. U.S. Geol. Surv. Nebraska, p. 240, pl. iv. fig. 19.
1873. *Diplodus compressus*, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. i. pt. ii. p. 335.
1875. *Diplodus compressus*, J. S. Newberry, *op. cit.* vol. ii. pt. ii. p. 45, pl. lviii. fig. 2.

Type. Detached tooth.

Teeth as large as those of *D. gibbosus*. Principal cusps of dental crown extremely compressed, divergent, with serrated edges: anterior median denticle comparatively long and slender.

It is uncertain whether this supposed species is not the young of *D. latus*.

Form. & Loc. Coal-Measures: Indiana, Ohio, Nebraska.

P. 1718. Two teeth; Linton, Ohio. *Egerton Coll.*

Diplodus gracilis, Newberry.

1856. *Diplodus gracilis*, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. p. 99.
1873. *Diplodus gracilis*, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. i. pt. ii. p. 335.
1875. *Diplodus gracilis*, J. S. Newberry, *op. cit.* vol. ii. pt. ii. p. 45, pl. lviii. fig. 3.

Type. Detached tooth.

Doubtfully distinct from *D. compressus*: the typical teeth only differ from those of the latter species in the less compressed and more slender character of the principal cusps.

Form. & Loc. Coal-Measures: Ohio.

P. 1719. Two teeth; Linton. *Egerton Coll.*

P. 3029. Another tooth; Linton. *Enniskillen Coll.*

Diplodus acinaces, Dawson.

1860. *Diplodus acinaces*, J. W. Dawson, Acad. Geol., Suppl. p. 46, fig. 43.
1878. *Diplodus acinaces*, J. W. Dawson, Acad. Geol., 3rd ed. p. 211, fig. 58.

Type. Detached tooth.

Teeth robust; principal cusps of the crown moderately compressed, without serrated edges, one much larger than the other, and only slightly divergent; anterior median denticle small, slender.

Form. & Loc. Coal-Measures: Nova Scotia.

P. 1721. Five teeth; Pictou. *Egerton Coll.*

Diplodus bohemicus, Quenstedt.

1882. *Diplodus bohemicus*, F. A. Quenstedt, Handb. Palæont. 3rd edit. p. 277, pl. xxi. figs. 35–37.

Type. Detached tooth.

Adult teeth equalling those of *D. latus* in size, and apparently only differing in the somewhat greater length and slenderness of the anterior median denticle.

Form. & Loc. Lower Permian (Gaskohle): Bohemia.

47484. Two large teeth, almost perfect; Kounová, near Rakonitz. *Purchased*, 1876.

P. 3032. Similar tooth; Kounová. *Enniskillen Coll.*

47486. Two small teeth, probably of this species: Nyřan, near Pilsen. *Purchased*, 1876.

The following species have also been founded upon detached teeth, but there are no examples in the Collection :—

Diplodus bicornis: *Thrinacodus bicornis*, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1879, p. 344.—St. Louis Limestone; Indiana.

Diplodus duplicatus, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 61, pl. iv. fig. 3; *Thrinacodus duplicatus*, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 289.—Keokuk Limestone; Illinois.

Diplodus incurvus, Newberry & Worthen, *tom. cit.* p. 62, pl. iv. fig. 4; *Thrinacodus incurvus*, St. John & Worthen, *tom. cit.* p. 289.—Keokuk Limestone; Illinois.

Diplodus levidens: *Orthacanthus levidens*, A. Fritsch, Sitzungsb. königl. böhm. Ges. Wiss. 1879, p. 189 (undefined).—Lower Permian; Kounová, Bohemia.

Diplodus nanus: *Thrinacodus nanus*, St. John & Worthen, *tom. cit.* p. 289, pl. v. figs. 1, 2.—Kinderhook Limestone; Iowa.

Diplodus penetrans, J. W. Dawson, Acadian Geology, Suppl. Chapter, 1860, p. 50, fig. 42; also *op. cit.* 3rd edit. (1878), p. 211, woodc. fig. 57.—Coal-Measures; Nova Scotia.

Diplodus plicatus, A. Fritsch, *loc. cit.* 1879, p. 189 (undefined).—Lower Permian; Kněžoves, Bohemia.

Skulls of two species from the Permian of Texas, possessing teeth generically identical with those named *Diplodus*, have been described by Prof. E. D. Cope under the names of *Didymodus texensis* and *D. platypternus*. The pterygo-quadrate cartilage articulates with the postorbital process of the cranium, and the

hyomandibular is slender, as in *Notidanus* and the later Hybodonts. The cartilages are permeated throughout by centres of calcification; but, as already remarked by Garman [1], Cope's determination of distinct tracts as corresponding to several "elements" [2] must be regarded as very doubtful. The following is the synonymy of the two species:—

Didymodus texensis, E. D. Cope, Trans. Amer. Phil. Soc. vol. xvi. (1887), p. 285; *Didymodus*, Cope, Amer. Nat. 1884, p. 412, and *D. compressus* (Newberry), Proc. Amer. Phil. Soc. 1884, p. 573; *Diacranodus compressus*, S. Garman, Bull. Mus. Comp. Zool. Harvard Coll. vol. xii. no. 1 (1885), p. 30.

Didymodus platypternus, E. D. Cope, Proc. Amer. Phil. Soc. 1884, p. 530, and Amer. Nat. 1884, p. 412; ***Diacranodus platypternus*, Garman, *loc. cit.* p. 30.**

If truly generically distinct from *Pleuracanthus*, it will be preferable to adopt the name *Diacranodus*, the term *Didymodon* having already been occupied for a mammal (Blake, Geologist, vol. vi. 1863, p. 8).

Teeth identical with those named *Diplodus* also occur in the Keuper of Somersetshire (Moore Collection, Bath Museum).

Genus **CHONDRENCHELYS**, Traquair.

[Geol. Mag. Dec. 3, vol. v. 1888, p. 103.]

This imperfectly known and remarkable genus is provisionally associated with the Pleuracanthidæ, on account of the striking resemblance of its axial skeleton to that of the Permian fishes described above as *Pleuracanthus decheni*. The body is very similar in form; there is the same long dorsal fin and pointed tail; the calcifications in the sheath of the notochord appear to agree in every particular; and the cartilaginous apophyses have a similar "beaded" appearance. In *Chondrenchelys*, however, there is no dorsal spine; the interneural supports of the dorsal fin-rays seem to be in a single series, instead of in two; and no paired fins are distinguishable in known specimens, though the well-developed character of the pectoral girdle is suggestive of this circumstance being due to accident in preservation. The snout is pointed, and Dr. Traquair describes a "spicular-looking body lying longitudinally in the middle of the head," which may possibly be a parasphenoid membrane-bone.

[1] Bull. Mus. Comp. Zool. Harvard Coll. vol. xii. no. 1, p. 29.

[2] Proc. Amer. Phil. Soc. 1884, pp. 573–577.

Chondrenchelys problematica, Traquair.

1888. *Chondrenchelys problematica*, R. H. Traquair, *loc. cit.*

Type. Imperfect skeleton; Edinburgh Museum.

Single known species.

Form. & Loc. Lower Carboniferous (Calciferous Sandstone): Eskdale, Dumfriesshire.

P. 4085. Skeleton, 0·17 m. in length, more or less perfectly preserved in the caudal region, and displaying the characters of the type specimen. *Purchased*, 1883.

Family CLADODONTIDÆ.

An indefinable family, apparently closely allied to the Pleuracanthidæ. The only known example of the type genus, *Cladodus*, exhibits a pectoral fin in the form of a uniserial archipterygium—intermediate between the truly biserial one of *Pleuracanthus* and the pectoral fin of modern Sharks[1]. The two halves of the pectoral arch are described as separate, but no other parts of the skeleton are yet known.

Genus **CLADODUS,** Agassiz.

[Poiss. Foss. vol. iii. 1843, p. 196.]

Head broad, depressed; teeth in numerous series. Crown of tooth consisting of a principal cone, long, subulate, pointed and conical, with one or more similar, but smaller, cones on either side, the outer of these being generally the largest. Base expanded at right angles to the crown posteriorly, the front margin, bearing the coronal cones, being straight, the posterior semicircular.

Cladodus mirabilis, Agassiz.

1843. *Cladodus mirabilis*, L. Agassiz, Poiss. Foss. vol. iii. p. 197, pl. 22 *b*, figs. 9–13.

1843. *Cladodus milleri*, L. Agassiz, *tom. cit.* p. 199, pl. 22 *b*. figs. 22, 23.

1855. *Cladodus mirabilis*, F. McCoy, Brit. Palæoz. Foss. p. 619 (in part).

1860. *Cladodus mirabilis*, E. d'Eichwald, Lethæa Rossica, vol. i. p. 1604.

1862. *Cladodus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 105, pl. iii. fig. 6.

1864. *Cladodus mirabilis*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, vol. xxxvii. no. iii. p. 166, pl. iv. fig. 31.

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[1] R. H. Traquair, Geol. Mag. [3] vol. v. (1888), p. 83.

1883. *Cladodus mirabilis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 372, pl. xlix. figs. 1–5.

1883. *Cladodus destructor*, J. W. Davis, *tom. cit.* p. 376, pl. xlix. fig. 15.

1883. *Cladodus milleri*, J. W. Davis, *tom. cit.* p. 378, pl. xlix. fig. 16.

1883. *Cladodus mucronatus*, J. W. Davis, *tom. cit.* p. 380, pl. xlix. fig. 21.

1883. *Cladodus basalis*, J. W. Davis, *tom. cit.* p. 379, pl. xlix. fig. 18.

1884. *Cladodus mucronatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 619, pl. xxvii. fig. 10.

1888. *Cladodus mirabilis*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 81.

Type. Detached teeth: Geological Society of London.

Teeth very robust, the crown consisting of a median principal cone, and two or three large lateral cones on each side. The cones are very slightly compressed, though with sharp lateral edges towards the apex, which is acute: all are marked from the base upwards throughout the greater portion of their length with delicate longitudinal striæ. The summits of the cones are slightly inclined backwards, and those of the extreme lateral pair also outwards.

Form. & Loc. Lower Carboniferous Limestone: Armagh and Wexford, Ireland; Somersetshire, Shropshire, and Derbyshire, England. Upper Carboniferous Limestone (Yoredale Rocks): Derbyshire and Yorkshire, England. Lower Carboniferous: Government of Toula, Russia.

P. 2925–9. Five specimens, figured by J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. pl. xlix. figs. 1–5; Armagh and Tynan. *Enniskillen Coll.*

P. 2938. Type specimen of *C. destructor*, Davis; Armagh. As noted by R. H. Traquair, this is almost certainly a fragment of a large tooth of *C. mirabilis*. *Enniskillen Coll.*

P. 2930. Eighteen teeth: Armagh. Four are small, resembling the so-called *C. basalis*. *Enniskillen Coll.*

P. 2937. Very large tooth, much crushed: Armagh. *Enniskillen Coll.*

P. 1317. Two small broken teeth; Armagh. *Egerton Coll.*

P. 1318. Small abraded tooth, showing a minute cusp beyond the ordinarily outermost lateral cone: Hook Point, Wexford. *Egerton Coll.*

34972. Imperfect tooth from the "Black Rock," Bristol, similar to the type specimen of *C. milleri* preserved in the Bristol Museum. The characters of the coronal striæ appear to

vary; and teeth of this form may thus be provisionally placed with *C. mirabilis*. *Purchased*, 1860.

P. 1319 a. Fragment of similar tooth, from the "Black Rock," labelled by Agassiz *C. mirabilis*. *Egerton Coll.*

34973. An imperfect tooth, the denticles unusually numerous and slender; Bristol. *Purchased*, 1860.

P. 2952. Base of a large and a small tooth; Bristol. *Enniskillen Coll.*

P. 1319, P. 2919. Group of much broken small teeth in limestone, bearing Agassiz's MS. label; Bristol. *Egerton & Enniskillen Colls.*

36465. Two imperfect small teeth, one figured in Quart. Journ. Geol. Soc. vol. xviii. pl. iii. fig. 6; Oreton, Shropshire. *Presented by G. E. Roberts, Esq.*, 1862.

42216. Seven imperfect teeth; Oreton. *Baugh Coll.*

46821. Small tooth; Derbyshire. *Gilbertson Coll.*

P. 5360. Three imperfect teeth, detached from matrix; Ticknall, S. Derbyshire. *Wilson Coll.*

P. 4893. Four teeth; Wensleydale, Yorkshire. *Horne Coll.*

49628. Abraded and broken tooth, apparently of this species; Richmond, Yorkshire. *Purchased*, 1878.

Cladodus marginatus, Agassiz.

1843. *Cladodus marginatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 198, pl. 22 *b*. figs. 18–20.
1843. *Cladodus acutus*, L. Agassiz, *tom. cit.* p. 199, pl. 22 *b*. fig. 21.
1848. *Cladodus lævis*, F. McCoy, Ann. & Mag. Nat. Hist. [2] vol. ii. p. 133.
1855. *Cladodus lævis*, F. McCoy, Brit. Palæoz. Foss. p. 619, pl. 3 K. fig. 5.
1855. *Cladodus mirabilis*, F. McCoy, *op. cit.* p. 619 (in part).
1883. *Cladodus marginatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 373, pl. xlix. figs. 7–9.
1883. *Cladodus curvus*, J. W. Davis, *tom. cit.* p. 564, pl. xlix. fig. 6.
1883. *Cladodus acutus*, J. W. Davis, *tom. cit.* p. 377, pl. xlix. fig. 17.

Type. Detached teeth; Geological Society of London.

Teeth robust, the crown consisting of a median principal cone, and not more than two lateral cones on each side. The cones are much compressed, with sharp lateral edges; except when worn, they are marked by few small irregular, sharp striæ. The apex of the

principal cone is generally obliquely directed to one side, and the lateral cones are incompletely separated, the exterior diverging outwards.

The teeth of this species are often extraordinarily worn.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2933–6. Four specimens, figured by J. W. Davis, *loc. cit.* pl. xlix figs. 6–9. *Enniskillen Coll.*

P. 2937, P. 2951. Twenty more or less broken and abraded teeth. *Enniskillen Coll.*

P. 2932. Three teeth; Tynan, Armagh. *Enniskillen Coll.*

38508. Small worn tooth, smooth. *Purchased*, 1864.

P. 2943. Five small teeth. *Enniskillen Coll.*

Cladodus striatus, Agassiz.

1843. *Cladodus striatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 197, pl. 22 *b*. figs. 14–17.

1855. *Cladodus striatus*, F. McCoy, Brit. Palæoz. Foss. p. 620.

(?) 1878. *Cladodus striatus*, L. G. de Koninck, Faune Calc. Carb. Belg. (Ann. Mus. Roy. d'Hist. Nat. Belg.) vol. ii. pt. i. p. 26, pl. iii. fig. 3.

1883. *Cladodus striatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 375, pl. xlix. figs. 12, 13.

1883. *Cladodus elongatus*, J. W. Davis, *tom. cit.* p. 374, pl. xlix. figs. 10, 11.

1883. *Cladodus curtus*, J. W. Davis (non *C. curtus*, Davis, 1881), *tom. cit.* p. 379, pl. xlix. fig. 19.

1883. *Cladodus hornei*, J. W. Davis, *tom. cit.* p. 380, pl. xlix. fig. 20.

1884. *Cladodus hornei*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 619, pl. xxvii. fig. 11.

1884. *Cladodus striatus*, J. W. Davis, *tom. cit.* p. 619.

1888. *Cladodus striatus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 81.

Type. Detached teeth; Geological Society of London.

Crown of teeth with long slender principal cone, and a numerous series of small lateral cones. The outer pair of lateral cones is much the largest, those placed between being very small and five or six in number on each side: the anterior margin of the crown is also covered by a narrow irregular cluster of very small projecting points. The crown is marked by numerous fine longitudinal striæ, and the principal cone is compressed, with a pair of sharp lateral edges.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland. Upper Carboniferous Limestone: Northumberland, Westmoreland, Yorkshire, Derbyshire, Shropshire, England.

P. 2920–1. Two teeth, figured by J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. pl. xlix. figs. 12, 13; Tynan, Armagh. *Enniskillen Coll.*

P. 2923. Twenty-six teeth; Armagh. *Enniskillen Coll.*

P. 1317, P. 1320. Portions of two small teeth, and base of tooth; Armagh. *Egerton Coll.*

P. 2922, P. 2944. Thirteen specimens, variously broken; Tynan, Armagh. *Enniskillen Coll.*

P. 2942. Nine small teeth, one abnormal and double; Armagh. *Enniskillen Coll.*

P. 5149. Two teeth; Tynan, Armagh. *Egerton Coll.*

35468–71. Four small teeth; Richmond, Yorkshire. *Purchased*, 1860.

36176. Tooth associated with fragment of *Erismacanthus*; Richmond. *Purchased*, 1862.

P. 2924. Seven teeth, one detached from matrix; Richmond. *Enniskillen Coll.*

P. 4892, P. 4898. Six teeth; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 1321. Two teeth, probably from Yorkshire. *Egerton Coll.*

46825–8. Portions of ten teeth; Derbyshire. *Gilbertson Coll.*

P. 5361. Seven portions of teeth; Ticknall, S. Derbyshire. *Wilson Coll.*

P. 210. Tooth, probably of this species; Oreton, Shropshire. *Weaver Jones Coll.*

36485. Bases of two teeth: Oreton. *Presented by G. E. Roberts, Esq.*, 1862.

Cladodus curvus, Davis.

1883. *Cladodus curvus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 376, pl. xlix. fig. 14.

Type. Detached tooth; British Museum.

Founded upon a unique tooth, with a much curved principal cone, and two very large lateral cones, strongly marked with striations. The tooth has the appearance of being malformed.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2939. Type specimen. *Enniskillen Coll.*

Cladodus grandis, Newberry & Worthen.

1866. *Cladodus grandis*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 29, pl. i. fig. 15.

Type. Detached tooth.

Teeth very large and robust. Principal cone broad, moderately compressed, with sharp lateral edges; outermost lateral cones large, slender, diverging, others relatively small, 4–7 in number on each side. Coronal surface marked by numerous delicate vertical striæ.

Form. & Loc. Lower Carboniferous (Chester Limestone): Illinois, U.S.A.

P. 2948. Two broken principal dental cones; Pope Co., Illinois. *Enniskillen Coll.*

Cladodus robustus, Newberry & Worthen.

1866. *Cladodus robustus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 20, pl. i. fig. 1.

1866. *Cladodus micropus*, Newberry & Worthen, *tom. cit.* p. 21, pl. i. fig. 2.

1866. *Cladodus angulatus*, Newberry & Worthen, *tom. cit.* p. 24, pl. i. figs. 7, 8.

1866. *Cladodus turritus*, Newberry & Worthen, *tom cit.* p. 28, pl. i. fig. 14.

Type. Detached tooth.

Crown of tooth relatively high, base small. Principal cone elongate, sigmoidal, compressed, with sharp lateral edges, and delicately striated; lateral cones very small, not more than two on either side.

Messrs. Newberry and Worthen have already suggested the possibility of the four forms of teeth, here assigned to *C. robustus*, pertaining to different parts of the mouth of one individual. It is inconvenient to separate them specifically by characters so slight as those referred to in the several diagnoses.

Form. & Loc. Lower Carboniferous (Keokuk Limestone): Illinois, U.S.A.

P. 2950. Broken fragment of principal cone; Warsaw, Illinois. *Enniskillen Coll.*

P. 2946. Tooth of the form of "*C. micropus*"; Warsaw, Illinois. *Enniskillen Coll.*

P. 2947. Similar, more perfect tooth; Warsaw, Illinois. *Enniskillen Coll.*

P. 2941. Fifteen fragmentary teeth, probably of this species; Warsaw, Illinois. *Enniskillen Coll.*

Cladodus spinosus, Newberry & Worthen.

1866. *Cladodus spinosus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 22, pl. i. fig. 3.

Type. Detached tooth.

Principal cone of tooth long and slender, circular in section below, compressed near the apex, delicately striated; lateral cones 6–7 on either side, the outer pair much the largest. Anterior base-line of crown beset with numerous minute pointed prominences.

Form. & Loc. Lower Carboniferous (St. Louis Limestone): Missouri, U.S.A.

P. 2949. Tooth showing posterior aspect; St. Louis, Missouri. *Enniskillen Coll.*

Cladodus springeri, St. John & Worthen.

1875. *Cladodus springeri*, St. John & Worthen, Pal. Illinois, vol. vi. p. 259, pl. ii. figs. 1–13.

1878. *Cladodus springeri*, L. G. de Koninck, Faune Calc. Carb. Belg. (Ann. Mus. Roy. d'Hist. Nat. Belg.) vol. ii. pt. i. p. 28, pl. iii. figs. 5–6.

Type. Detached teeth.

Principal cone of tooth long and slender, slightly compressed, with sharp lateral edges throughout its length. Lateral denticles long and slender, not more than four in number on each side, and alternating in size; the outer pair generally the largest and diverging. The anterior base-line of the crown is often beset with numerous minute pointed prominences; the principal cone is marked nearly to the apex by few, irregular, delicate sharp striæ, the lateral cones also with the bolder striæ extending to the apex.

L. G. de Koninck[1] has suggested that the teeth named *C. alternatus*, *C. succinctus*, and *C. wachsmuthi*, not improbably belong to this species—a suggestion which the respective figures and descriptions appear to the present writer to render most justifiable. It is also not unlikely that some of the Russian teeth referred by Trautschold[2] to *C. lamnoides* truly pertain to *C. springeri*. The original of Trautschold's fig. 3 *b*, pl. xxviii. *loc. cit.*, is evidently much abraded, and this fact may account for some of the differences to be observed.

Form. & Loc. Lower Carboniferous (Kinderhook Formation): Iowa, U.S.A. Carboniferous Limestone: Tournai, Belgium; Mjatschkowa, Russia.

[1] *Op. cit.* pt. i. p. 29.

[2] Nouv. Mém. Acad. St. Pétersb. vol. xiii. 1874, p. 286, pl. xxviii. figs. 3 *a–c*.

P. 5114. One nearly perfect tooth, and three less complete specimens, probably referable to this species; Mjatschkowa, Government of Moscow. *Purchased*, 1886.

The following species have also been founded upon teeth, mostly detached and isolated; but there are no examples in the Collection:—

Cladodus acuminatus, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. 1856, p. 99; also Rep. Geol. Surv. Ohio, vol. ii. pt. ii. (1875), p. 45, pl. lviii. fig. 4.—Coal-Measures; Tuscarawas Co., Ohio.

Cladodus alternatus, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 265, pl. ii. figs. 14–18.—Kinderhook Limestone; Iowa.

Cladodus bellifer, St. John & Worthen, *tom. cit.* p. 270, pl. iv. fig. 10; L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 27, pl. iii. fig. 4.—Burlington Limestone; Iowa. L. Carboniferous Limestone (Bed 1 *e*); Tournai, Belgium.

Cladodus carinatus, St. John & Worthen, *tom. cit.* p. 279, pl. iv. figs. 6, 7.—Coal-Measures; Illinois, Iowa.

Cladodus concinnus, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. (1875), p. 48, pl. lviii. fig. 8.—Huron Shale; Lorain Co., Ohio.

Cladodus conicus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 199, pl. 22 *b*. fig. 24; J. W. Davis, Trans. Roy. Dublin Soc. (2) vol. i. (1883), p. 378.—Lower Carboniferous Limestone; Bristol.

Cladodus costatus, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 27, pl. i. fig. 13.—Chester Limestone; Illinois.

Cladodus deflexus, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 355, pl. iii. fig. 3.—Burlington Limestone; Illinois.

Cladodus divaricatus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 267, pl. xxvi. fig. 4.—L. Carboniferous Limestone; Govt. of Toula, Russia.

Cladodus divergens, H. Trautschold, *loc. cit.* vol. xiv. (1879), p. 51, pl. vi. fig. 11.—L. Carboniferous Limestone; Mjatschkowa, Moscow.

Cladodus excentricus, St. John & Worthen, *tom. cit.* p. 272, pl. iv. fig. 4.—St. Louis Limestone; Illinois, Missouri.

Cladodus flexus, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 354, pl. iv. fig. 9.—St. Louis Limestone; Missouri.

Cladodus euglypheus, St. John & Worthen, *tom. cit.* p. 274, pl. iv. figs. 1–3.—St. Louis Limestone; Illinois, Iowa, Missouri.

Cladodus exiguus, St. John & Worthen, *tom. cit.* p. 261, pl. iii. figs. 13–15.—Kinderhook Limestone; Iowa.

Cladodus exilis, St. John & Worthen, *tom. cit.* p. 258, pl i. figs. 1–6.—Kinderhook Limestone; Iowa.

Cladodus ferox, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 26, pl. i. fig. 11.—St. Louis Limestone; Missouri.

Cladodus fulleri, St. John & Worthen, *tom. cit.* p. 276, pl. iv. fig. 9.—Coal-Measures; Illinois, Iowa.

Cladodus gomphoides, St. John & Worthen, *tom. cit.* p. 269, pl. iv. figs. 12–16.—Upper Burlington Limestone; Iowa.

Cladodus gracilis, Newberry & Worthen, *op. cit.* vol. ii. p. 30, pl. i. fig. 17.—Coal-Measures; Indiana.

(This species is considered as young of *C. lamnoides* by H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. p. 287.)

Cladodus hertzeri, J. S. Newberry, Rep. Ohio, vol. ii. pt. ii. (1875), p. 46, pl. lviii. fig. 5.—Limestone below Berea Grit; Ohio.

Cladodus hibberti, L. Agassiz, *tom. cit.* p. 200, pl. 22 *b*. fig. 26.—Calciferous Sandstone; Burdiehouse, near Edinburgh.

Cladodus intercostatus, St. John & Worthen, *tom. cit.* p. 267, pl. iv. fig. 11.—Burlington Limestone; Illinois, Iowa.

Cladodus ischypus, Newberry & Worthen, *op. cit.* vol. iv. p. 354, pl. iv. fig. 6.—St. Louis Limestone; Missouri.

Cladodus keokuk, St. John & Worthen, *tom. cit.* p. 268.—Keokuk Limestone; Illinois, Iowa.

Cladodus lamnoides, Newberry & Worthen, *op. cit.* vol. ii. p. 30, pl. i. fig. 16.—Keokuk Limestone; Illinois.

Cladodus magnificus, Tuomey; Newberry & Worthen, *op. cit.* vol. ii. p. 24, pl. i. fig. 6.—Lower Carboniferous; Alabama.

Cladodus obtusus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 266, pl. xxvi. fig. 2.—L. Carboniferous (U. Devonian); Govt. of Toula, Russia.

Cladodus occidentalis, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1859, p. 3; Ext. Vert. West. Territ. (U.S. Geol. Surv. 1873), p. 311, pl. xvii. figs. 4–6: *C. mortifer*, Newberry & Worthen, *op. cit.* vol. ii. p. 22, pl. i. fig. 5; O. St. John, Proc. Amer. Phil. Soc. vol. xi. (1870), p. 431; also in Hayden's Final Rep. U.S. Geol. Surv. Nebraska, 1872, p. 239, pl. iii. fig. 6, pl. vi. fig. 13.—U. Coal-Measures; Kansas, Nebraska, Illinois.

Cladodus pandatus, St. John & Worthen, *tom. cit.* p. 278, pl. iv. fig. 8.—Coal-Measures; Illinois.

Cladodus parvulus, J. S. Newberry, Rep. Ohio, vol. ii. pt. ii. (1875), p. 48, pl. lviii. fig. 9.—Fish-bed in Valley of Black River, Ohio.

Cladodus parvus, L. Agassiz, *tom. cit.* p. 200, pl. 22 *b*. figs. 26, 27.—Calciferous Sandstone; Burdiehouse, near Edinburgh.

Cladodus pattersoni, J. S. Newberry, Rep. Ohio, vol. ii. pt. ii. (1875), p. 47, pl. lviii. fig. 6.—Waverly Group; Ohio. [A jaw with the nearly complete dentition is noticed, but not figured or fully described. The teeth are said to vary little except in size, and the total number in one mouth is probably 300–400.]

Cladodus politus, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 27, pl. i. fig. 12.—Chester Limestone; Illinois.

Cladodus prænuntius, St. John & Worthen, *tom. cit.* p. 270, pl. iv. fig. 17.—Upper Burlington Limestone; Iowa.

Cladodus primigenius, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 266, pl. xxvi. fig. 3.—Lower Carboniferous (U. Devonian); Govt. of Toula, Russia.

Cladodus raricostatus, St. John & Worthen, *tom. cit.* p. 271, pl. iv. fig. 18.—Keokuk Limestone; Iowa.

Cladodus remingeri, J. S. Newberry, Rep. Ohio, vol. ii. pt. ii. (1875), p. 49.—Waverly Group; Michigan.

Cladodus simplex, L. Agassiz, Poiss. Foss. V. Grès Rouge, 1844, p. 124, pl. 33. figs. 29–31: *Hybodus longiconus*, E. d'Eichwald, Bull. Soc. Imp. Nat. Moscou, vol. xix. 1846, no. iv. p. 293, pl. x. fig. 14: *Homacanthus triangularis*, E. d'Eichwald, Leth. Ross. vol. i. (1860), p. 1601: *Cladodus simplex*, Semenov and Möller, Bull. Acad. St. Pétersb. vol. vii. (1864), p. 235, pl. i. fig. 12; H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 265, pl. xxvi. fig. 1.—Devonian; near St. Petersburg.

Cladodus stenopus, Newberry & Worthen, *op. cit.* vol. ii. p. 23, pl. i. fig. 4.—St. Louis Limestone; Illinois.

Cladodus subulatus, J. S. Newberry, Rep. Ohio, vol. ii. pt. ii. (1875), p. 47, pl. lviii. fig. 7.—Shale over Berea Grit; Ohio.

Cladodus succinctus, St. John & Worthen, *tom. cit.* p. 265, pl. iii. figs. 8–12.—Kinderhook Limestone; Iowa.

Cladodus van-hornei, St. John & Worthen, *tom. cit.* p. 273, pl. iv. fig. 5.—St. Louis Limestone; Illinois.

Cladodus vachsmuthi, St. John & Worthen, *tom. cit.* p. 263, pl. iii. figs. 1–7.—Kinderhook Limestone; Iowa.

Cladodus zygopus, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 25, pl. i. figs. 9, 10.—Chester Limestone: Illinois.

A portion of the skeleton, with the teeth, of a species allied to *C. mirabilis*, from the Carboniferous Limestone of East Kilbride, Lanarkshire, has been briefly noticed by R. H. Traquair (Geol. Mag. 1888, p. 82), and will be described in the Trans. Geol. Soc. Glasgow.

A fragmentary fossil, apparently the base of a cephalic spine of *Hybodus*, from the Rhætic Bone-bed of Aust near Bristol, has been described under the name of *Cladodus curtus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. (1881), p. 424, pl. xxii. fig. 9.

Genus **DICENTRODUS**, Traquair.

[Geol. Mag. dec. 3, vol. v. 1888, p. 86.]

Teeth of the same type as those of *Cladodus*, but having the crown unsymmetrical, consisting of one large cone, with a smaller cone on one side only—the latter rarely absent.

Dicentrodus bicuspidatus, Traquair.

1881. *Cladodus bicuspidatus*, R. H. Traquair, Geol. Mag. [2] vol. viii. p. 35.

1888. *Dicentrodus bicuspidatus*, R. H. Traquair, *loc. cit.* [3] vol. v. p. 86.

Type. Detached teeth; Edinburgh Museum.

Usual length of tooth from $\frac{1}{8}$ to $\frac{1}{2}$ inch. Base narrow, slightly reniform, gently convex behind, and slightly notched in front at the base of the principal cone. Principal cone varying much in slenderness, smooth, acutely pointed, sharply carinated on both sides from its origin, more or less flexed backwards, and sometimes also inclined to one side.

Form. & Loc. Middle Carboniferous Limestone (Blackband Ironstone): Borough Lee, near Edinburgh.

P. 2295. Large tooth, one cone being broken away and shown in impression (Pl. VI. fig. 7).

Presented by Mrs. Burton, 1882.

P. 4496. Seven small teeth, two shown in Pl. VI. figs. 8, 9.

Presented by Dr. R. H. Traquair, 1884.

Genus **PHŒBODUS**, St. John & Worthen.

[Pal. Illinois, vol. vi. 1875, p. 251.]

Syn. *Bathycheilodus*, St. John & Worthen, Pal. Illinois, vol. vi. 1875, p. 252.

Teeth very similar to those of *Cladodus*, but having the outer lateral cones as large as, or larger than, the median cone. Intermediate cones, one, two, or three in number, very small.

Phœbodus sophiæ, St. John & Worthen, *tom. cit.* p. 251, pl. i. fig. 14.—Middle Devonian; Iowa.

Phœbodus macisaacsii: *Bathycheilodus macisaacsii*, St. John & Worthen, *tom. cit.* p. 252, pl. i. figs. 12, 13.—Middle Devonian; Iowa.

Phœbodus springeri[1]: *Pristicladodus springeri*, St. John & Worthen, *tom. cit.* p. 255, pl. i. figs. 7–11.—Kinderhook Limestone; Iowa.

Genus **LAMBDODUS**, St. John & Worthen.

[Pal. Illinois, vol. vi. 1875, p. 280.]

Teeth small, similar to those of *Cladodus*, but destitute of lateral cones.

Lambdodus calceolus, St. John & Worthen, *tom. cit.* p. 281, pl. v. fig. 5.—Burlington Limestone; Iowa, Illinois.

Lambdodus costatus, St. John & Worthen, *tom. cit.* p. 280, pl. v. fig. 3.—Burlington and Keokuk Limestones; Iowa, Illinois, Missouri.

Lambdodus hamulus, St. John & Worthen, *tom. cit.* p. 283, pl. v. fig. 26.—Chester Limestone; Illinois.

Lambdodus reflexus, St. John & Worthen, *tom. cit.* p. 284, pl. v. fig. 25.—Chester Limestone; Illinois.

Lambdodus robustus, St. John & Worthen, *tom. cit.* p. 282, pl. v. fig. 6.—Keokuk Limestone; Iowa, Illinois, Missouri.

Lambdodus transversus, St. John & Worthen, *tom. cit.* p. 282, pl. v. fig. 4.—St. Louis Limestone; Illinois.

[1] S. Garman (Bull. Mus. Comp. Zool. Harvard Coll. vol. xii. no. 1, 1885, p. 6) proposes the generic name of *Pternodus* for this species. This, however, seems unnecessary, and the term has already been occupied by R. Owen (Trans. Odontol. Soc. 1867) for a supposed Carboniferous genus.

Genus **DICRENODUS**, Romanowsky[1].

[Bull. Soc. Imp. Nat. Moscou, vol. xxvi. no. 1, 1853, p. 407.]

Syn. *Carcharopsis*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 313 (undefined); J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 381.

Pristicladodus, F. McCoy, Brit. Palæoz. Foss. 1855, p. 642.

Crown of tooth relatively large, thick, and conical, but much compressed, with the two cutting-edges coarsely denticulated; lateral cones absent, or not more than two on each side. Base expanded at right angles to the crown posteriorly, thick, subsemicircular in shape.

Both the specimens to which Agassiz gave the name of *Carcharopsis* being contained in the Enniskillen Collection and mentioned below, it can be determined definitely that they are generically identical with the teeth described by Romanowsky as *Dicrenodus* and by McCoy as *Pristicladodus*. The present writer has seen no evidence of the difference in the form of the root remarked upon by J. W. Davis, *loc. cit.*

Dicrenodus dentatus (McCoy).

1843. *Carcharopsis prototypus*, L. Agassiz, Poiss. Foss. vol. iii. p. 313 (name only).

1855. *Pristicladodus dentatus*, F. McCoy, Brit. Palæoz. Foss. p. 642, pl. 3 G. fig. 2.

1883. *Pristicladodus dentatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 384, pl. xlix. fig. 22.

1883. *Carcharopsis colei*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 383, pl. xlix. fig. 26.

1884. *Pristicladodus dentatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 620, pl. xxvii. fig. 4.

1888. *Pristicladodus dentatus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 103.

Type. Detached tooth.

Denticulations of coronal margin large, well-defined, abruptly truncated; no lateral cones.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland. Upper Carboniferous Limestone: Ayrshire, Scotland; Yorkshire, Derbyshire, England.

46044. Imperfect tooth; Beith, Ayrshire.

Presented by Robert Craig, Esq., 1874.

[1] The identity of this genus with *Childus*, Giebel (Fauna Vorw. vol. i. 1847, p. 352), asserted by Giebel and Heintz (Zeitschr. gesammt. Naturw. 1854, p. 77), must be regarded as very doubtful.

P. 5445. Impression of portion of dental crown, referred by Agassiz, *loc. cit.*, to *Carcharopsis prototypus*; Pateley Bridge, Yorkshire. *Enniskillen Coll.*

P. 2267. Portion of tooth and impression; Yorkshire. *Egerton Coll.*

P. 4886. Two teeth: Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

46822. Broken tooth; Derbyshire. *Gilbertson Coll.*

P. 5446. Type specimen of *Carcharopsis colei*, Davis, regarded by Traquair as the abraded crown of a similar tooth: Armagh. *Enniskillen Coll.*

The following species have also been founded upon detached teeth; but there are no examples in the Collection:—

Dicrenodus goughi: *Pristicladodus goughi*, F. McCoy, Brit. Palæoz. Foss. 1855, p. 643, pl. 3 K. fig. 11.—Carboniferous Limestone; Kettlewell, near Kendal.

Dicrenodus jerofeyewi: *Pristicladodus jerofeyewi*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, vol. xxxvii. (1864), pt. iii. p. 165, pl. iv. fig. 30.—Carboniferous Limestone; Government of Toula, Russia.

Dicrenodus okensis, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, vol. xxvi. no. 1 (1853), p. 407, pl. viii.; *ibid.* vol. xxx. no. 1 (1857), p. 290.—Carboniferous Limestone; Government of Toula, Russia.

Dicrenodus wortheni: *Carcharopsis wortheni*, J. S. Newberry, Pal. Illinois, vol. ii. (1866), p. 69, pl. iv. fig. 14.—Lower Carboniferous; Huntsville, Alabama.

Genus **HYBOCLADODUS**, St. John & Worthen.

[Pal. Illinois, vol. vi. 1875, p. 284.]

Teeth scarcely distinguishable from those of *Pristicladodus*, but destitute of crenulations upon the edge of the crown. No lateral cones.

Hybocladodus compressus, St. John & Worthen, *tom. cit.* p. 287, pl. v. fig. 8.—*Helodus compressus*, Newberry & Worthen, Pal. Illinois, vol. ii. 1866, p. 78, pl. v. fig. 1.—Upper Burlington Limestone; Iowa.

Hybocladodus intermedius, St. John & Worthen, *tom. cit.* p. 287, pl. v. fig. 11.—Keokuk Limestone; Iowa, Illinois.

Hybocladodus nitidus, St. John & Worthen, *tom. cit.* p. 288, pl. v. fig. 7.—Chester Limestone; Illinois.

Hybocladodus plicatilis, St. John & Worthen, *tom. cit.* p. 286, pl. v. fig. 9.—Upper Burlington Limestone; Iowa.

Hybocladodus tenuicostatus, St. John & Worthen, *tom. cit.* p. 286, pl. v. fig. 10.—Keokuk Limestone; Iowa, Illinois.

Order II. SELACHII.

Endoskeletal cartilage, as a rule, only superficially calcified. Notochord (except in a few early types) always more or less constricted in the adult. Neural and hæmal arches and spines stout, with intercalary cartilages in the more specialized forms. Pectoral fins without segmented axis. Axial cartilages of the hind limb prolonged into a clasper in the male.

Suborder I. *TECTOSPONDYLI.*

Vertebræ, when fully developed, having the concentric calcified laminæ predominating over the radiating laminæ (*tectospondylic*, Hasse). Specialization resulting in a depression of the body, and an enlargement of the pectoral fins; spiracles, of large size, retained in the most specialized forms. Anal fin absent.

Family SPINACIDÆ.

Body round or trihedral, and very slightly depressed. Mouth gently arched; snout obtuse. Pectoral fins not notched at their origin and not produced forward; gill-slits small, lateral, often in the line of the pectorals, often half below. Spiracles large, behind the eye.

Genus **CENTRINA,** Cuvier.

[Règne Animal, vol. ii. 1817, p. 130.]

Syn. *Oxynotus*, Rafinesque Schmalz, Ind. Ittiologia Siciliana, 1810, p. 60 (incomplete definition).

Powerful dorsal fin-spines present. Trunk rather elevated, trihedral, with a fold of skin extending along each side of the ventral surface. Teeth of the lower jaw erect, triangular, finely serrated; those of the upper slender, conical, forming a group in front of the jaw.

The following extinct species is founded upon detached teeth from the Pliocene of Orciano, Tuscany, described as scarcely distinguishable from those of the living *C. saviani* of the Mediterranean. The figures show them to be remarkably similar to the lower teeth of *Scymnus*.

Centrina bassanii, R. Lawley, Nuovi Studi sopra ai Pesci fossili etc. 1876, p. 39, pl. i. fig. 18.

Detached teeth from the Miocene of Castries, Hérault, France, have also been referred to *Centrina* by P. Gervais, Zool. & Pal. Gén. (1867–69) p. 238, pl. xlvii. fig. 5.

Genus **ACANTHIAS**, Risso.

[Hist. nat. prod. Europe mérid. vol. iii. 1826, p. 131.]

Syn. *Centrophoroides*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. 1887, p. 478.

Dorsal fin-spines present. Teeth rather small, triangular, compressed, with the apex much turned aside, one margin of the crown forming the functional cutting-edge; similar in both jaws.

Acanthias latidens (Davis).

1887. *Centrophoroides latidens*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 478, pl. xv. fig. 2.

Type. Anterior portion of fish: British Museum.

The only known examples of this species being very imperfect, it cannot be satisfactorily defined. No character is shown by which it can be separated from *Acanthias*. It has the form and proportions generally characterizing this genus: the upper teeth exhibit the same obliquity of the crown as the lower, only differing in their smaller size. The shagreen granules are similar to those of such recent species as *A. blainvillei*.

Form. & Loc. Upper Cretaceous (Turonian): Sahel Alma, Mount Lebanon, Syria.

P. 4021. Type specimen. *Purchased*, 1883.

P. 49467, 49470. Two fragments, showing shagreen, dorsal spines, and vertebræ. *Purchased*, 1878.

To this genus the following detached teeth have also been provisionally referred. They cannot be distinguished from the lower teeth of *Centrophorus*, but not being accompanied by any teeth similar to those of the upper jaw of the last-named genus, the present determination is perhaps correct.

Acanthias radicans, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 173, pl. iii. figs. 31, 32.—Molasse; Baltringen, Württemberg.

Acanthias serratus, J. Probst, *tom. cit.* p. 174, pl. iii. fig. 33.—Molasse; Schemmerberg and Altheim, Würtemberg.

A tooth of the living *Acanthias vulgaris*, Risso, is recorded from the Weybourn Crag of East Runton, Norfolk, by E. T. Newton, Vertebrata of the Forest-bed Series (Mem. Geol. Surv. 1882), p. 131, pl. xix. fig. 8.

Genus **CENTROPHORUS**, Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 88.]

Dorsal fin-spines present. Lower teeth as in *Acanthias*; upper teeth erect, triangular, or narrow lanceolate, with a single cusp.

Centrophorus primævus (Pictet).

1850. *Spinax primævus*, F. J. Pictet, Poiss. Foss. Mt. Liban, p. 53, pl. x. figs. 1–3.

1884. *Centrophorus*, C. Hasse, Palæontographica, vol. xxxi. p. 3, pl. i. fig. 1.

1887. *Spinax primævus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 477, pl. xvi. fig. 2.

Type. Portions of fishes; Geneva Museum.

Snout gently rounded, the length of the præoral portion being about equal to the maximum width of the head. Dorsal spines projecting beyond the skin. The length of the base of the first dorsal (without the spine) equals about one third the distance between the two fins; distal extremity of pelvic fins in advance of a point opposite the second dorsal. Shagreen-scales with three or four keels.

The teeth of the upper jaw being still unknown, the reference of this species to *Centrophorus* cannot be regarded as quite certain; it is not referable to *Spinax*, but may be an *Acanthias*.

Form. & Loc. Upper Cretaceous (Turonian): Sahel Alma, Mount Lebanon, Syria.

P. 4779. Specimen figured by J. W. Davis, *loc. cit.*
Purchased, 1884.

49468–9. Less complete head and portion of the trunk, showing impressions of the two dorsal fin-spines; also a smaller specimen exhibiting the lower teeth, a pectoral fin, and the two imperfect dorsal fin-spines. *Purchased*, 1878.

P. 4858. Crushed bent specimen, displaying well the lower aspect of the head and pectoral fins. *Purchased*, 1885.

Genus **SPINAX**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 129.]

Syn. *Acanthidium*, R. T. Lowe, Ann. & Mag. N. H. vol. iv. (1840), p. 422.

Dorsal fin-spines present. Lower teeth broad and compressed, the apex of the crown greatly turned aside; upper teeth slender, erect, each with a long pointed principal cusp, and one or two small denticles on either side.

Spinax bonapartei, R. Lawley, Nuovi Studi etc. 1876, p. 39 (name only).—Pliocene; Orciano and Volterra, Tuscany.

Genus **SCYMNUS**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 130.]

Dorsal fin-spines absent. Upper teeth small, pointed; lower teeth much larger, broad and compressed, triangular, erect in the adult, but somewhat oblique in the young.

Scymnus majori, Lawley.

1876. *Scymnus majori*. R. Lawley, Nuovi Studi sopra ai Pesci fossili etc. p. 38, pl. i. fig. 17.

Type. Detached teeth.

An imperfectly defined species, founded upon lower teeth with serrated edges, very similar to those of the living *S. lichia*.

Form. & Loc. Pliocene: Tuscany, Italy.

47029. Three teeth; Orciano. *Purchased*, 1875.

The following species have also been founded upon detached teeth but there are no examples in the Collection:—

Scymnus triangulus. J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 175, pl. iii. figs. 35, 36.—Molasse; Würtemberg.

Scymnus trituratus, J. Probst, *tom. cit.* p. 176: also F. Noetling, Sitzb. Ges. naturf. Fr. Berlin, 1886, p. 17: *Corax trituratus*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. (1874), fasc. i. p. 27, pl. ii. fig. 13.—Bruxellian; Woluwe St. Lambert, near Brussels.

Scymnus acutus, J. W. Davis, Geol. Mag. [3] vol. v. (1888), p. 315; "Young *Carcharodon angustidens*," J. W. Davis, Trans. Roy. Dubl. Soc. [2] vol. iv. (1888), p. 11, pl. vi. fig. 22.—Miocene; New Zealand.

Genus **ECHINORHINUS**, Blainville.

[Faune française—Poissons, 1828, p. 66.]

Syn. *Goniodus*, L. Agassiz, Poiss. Foss. vol. iii. 1838, p. 94.

Dorsal fins very small, without spine, the first opposite to the pelvics. Teeth equal in both jaws, very oblique, the point being turned outwards, and having one, two, or three strong horizontally directed denticulations on each side. Skin with scattered large round tubercles.

An extinct species (*E. richiardii*) is founded by R. Lawley (*op. cit.* 1876, p. 41, pl. i. fig. 8, pl. ii. fig. 6) upon teeth and dermal tubercles from the Pliocene of Orciano and Volterra, Tuscany.

An indeterminable fragment of a fish apparently referable to the Spinacidæ, from the Upper Cretaceous of Pietraroja, Naples, has been described under the name of *Centropterus lividus* by O. G. Costa, Paleont. Regno Napoli, pt. iii. (1857-63), p. 123, pl. xii. fig. 13. The unsatisfactory nature of the specimen has already been commented upon by F. Bassani, Denkschr. math.-naturw. Cl. kais. Akad. Wiss. Wien, vol. xlv. (1882), pt. ii. p. 37.

Family PETALODONTIDÆ.

Body moderately depressed; pectoral fins large, continued forwards towards the head. Teeth compressed antero-posteriorly, with root often relatively large; crown more or less bent backwards, either with a sharp cutting-edge, or very obtuse. When arranged in the mouth the teeth form a close pavement.

The genus *Janassa* affords the most complete insight into the characters of this family, the other genera, associated with it on account of the form of their teeth, being only known by these detached fragmentary fossils.

Genus **JANASSA**, Münster.

[Beitr. Petrefakt. Heft i. 1832, p. 67.]

Syn. *Dictea*, G. Münster, Beitr. Petrefakt. iii. 1840, p. 124.
Byzenos, G. Münster, Beitr. Petrefakt. vi. 1843, p. 50.
Climaxodus, F. McCoy, Ann. & Mag. Nat. Hist. [2] vol. ii. 1848, p. 128.
Peltodus, J. S. Newberry & A. H. Worthen, Pal. Illinois, vol. iv. 1870, p. 362.
Tanaodus, O. St. John & A. H. Worthen, Pal. Illinois, vol. vi. 1875, p. 367.
Strigiüna, E. D. Cope, Proc. Amer. Phil. Soc. vol. xvii. 1878, p. 52.

Teeth having the crown so much reflexed and thickened, that the complete dentition forms an exclusively tritoral surface. There are three principal rows of teeth, diminishing greatly in size towards the front of the mouth; and one or two smaller rows occur on each side, having the summit of the crown less bent and thickened than the others. The body is covered with fine, smooth shagreen granules, largest apparently on the inferior aspect of the head.

As recognized by K. A. von Zittel[1], the interpretation of the arrangement of the dentition of *Janassa* proposed by Hancock and Howse[2] is undoubtedly erroneous.

Janassa bituminosa (Schlotheim).

1762. Figure in Dresdinisches Magazin, vol. ii. pt. 4 (*H. B. Geinitz*).
1820. *Trilobites bituminosus*, E. Schlotheim, Petrefaktenk. p. 39.
1823. *Trilobites bituminosus*, E. Schlotheim, Nachtrag Petref. pt. ii. pp. 39, 87, pl. 22. fig. 9.
1832. *Janassa angulata*, G. Münster, Beitr. Petrefakt. i. p. 67, pl. iv. figs. 1, 2.
1832. *Janassa humboldti*, G. Münster, *op. cit.* i. p. 122, pl. xiv. fig. 4.
1832. ***Janassa bituminosa***, G. Münster, *op. cit.* i. p. 122.
1839. *Acrodus larva*, L. Agassiz, Poiss. Foss. vol. iii. p. 147, pl. 22. figs. 23–25.
1839. *Janassa angulata*, G. A. Kurtze, Dissert. Petrefakt. Mansfeld, p. 20.
1839. ***Janassa humboldti***, G. A. Kurtze, *op. cit.* p. 20.
1840. *Janassa angulata*, G. Münster, *op. cit.* iii. p. 122, pls. iii. & iv. fig. 5 *a*.
1840. *Dictea striata*, G. Münster, *op. cit.* iii. p. 124, pls. iii. & iv. figs. 1–4, pl. viii. figs. 3, 4, 6–10.
1840. *Janassa angulata*, F. Germar, Verstein. Mansfeld Kupferschief. p. 26, fig. 15.
1842. *Janassa dictea*, G. Münster, *op. cit.* v. p. 38, pl. xv. figs. 10–16.
1843. *Dictea striata* = *Acrodus larva*, L. Agassiz, *op. cit.* vol. iii. p. 376.
1843. *Byzenus intjaicratus*, G. Münster, *op. cit.* vi. p. 50, pl. i. fig. 2.
1851–6. *Janassa angulata*, F. Roemer, Bronn's Leth. geogn. 3rd edit. vol. i. p. 717, pl. ix[4]. fig. 13.
1851–6. *Dicteu striata*, F. Roemer, *tom. cit.* p. 718.
1861. *Janassa bituminosa*, H. B. Geinitz, Dyas, p. 24, pl. iv. fig. 5, pl. v. figs. 1–4.
1870. *Janassa bituminosa*, A. Hancock & R. Howse, Ann. & Mag. Nat. Hist. [4] vol. v. p. 47, pls. ii., iii.
1887. *Janassa bituminosa*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 98.

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[1] Handb. Palæont. vol. iii. (1887), p. 98.
[2] Ann. & Mag. Nat. Hist. [4] vol. v. (1870), p. 47, pl. ii.

Type. Detached tooth.

Crown of principal teeth very high, the lower two thirds of the posterior face being covered with numerous delicate transverse parallel rugæ.

Form. & Loc. Permian (Marl Slate, Kupferschiefer): Germany, N. England.

P. 3034. Portion of the dentition of both jaws, naturally associated. The three median longitudinal series are preserved in one jaw, but of the opposing dentition only two transverse rows from the hinder part of these series and the adjoining outer series are preserved; Riechelsdorf, Hessen.
Enniskillen Coll.

P. 3035. Broken teeth, cartilage, and shagreen; Riechelsdorf.
Enniskillen Coll.

P. 1374. Four much broken groups of teeth, with remains of calcified cartilage and shagreen; Riechelsdorf. *Egerton Coll.*

43424–5. Very complete, though much broken dentition, associated with shagreen, and preserved in counterpart; the shagreen granules are much larger immediately round the mouth than elsewhere. Also a more fragmentary specimen; Riechelsdorf.
Presented by Kenneth Murchison, Esq., 1872.

38592, 41084. Broken teeth, cartilage, and shagreen; Riechelsdorf.
Purchased, 1864.

P. 1375. Portions of dentition, associated with shagreen and fragments of calcified cartilage, in nodule; Ilmenau, Thüringia.
Egerton Coll.

P. 3033. Teeth described and figured by Hancock and Howse, *loc. cit.* p. 59, pl. ii. fig. 1; Midderidge, Durham.
Enniskillen Coll.

P. 1373. Tooth; Cullercoats, Northumberland. *Egerton Coll.*

Janassa linguæformis (Atthey).

1868. *Climaxodus linguæformis*, T. Atthey, Ann. & Mag. Nat. Hist. [4] vol. ii. p. 321. (Tyneside Nat. Field-Club, Oct. 9th, 1867.)
1868. *Climaxodus oratus*, T. P. Barkas, Geol. Mag. vol. v. p. 495.
1869. *Climaxodus vermiformis*, T. P. Barkas, Geol. Mag. vol. vi. p. 381.
1870. *Janassa linguæformis*, A. Hancock & T. Atthey, Nat. Hist. Trans. Northumb. & Durham, vol. iii. p. 330, pl. ix.

1873. *Climarodus*, T. P. Barkas, Coal Meas. Palæont. p. 20, pl. i. figs. 35–38.
1875. *Janassa linguæformis*, J. Ward, [Proc.] North Staffs. Nat. Field-Club, p. 222. fig. 8.
1875. *Janassa ovatus*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. iii. p. 153, figs. 49–54.
1875. ***Janassa minutus*, W. J. Barkas, *tom. cit.* p. 155, fig. 55.**
1875. *Janassa processus*, W. J. Barkas, *tom. cit.* p. 155, fig. 56.

Type. Detached tooth; Mus. Newcastle-on-Tyne.

Margin of crown comparatively thin, but much reflexed in the principal teeth. Posterior coronal imbricated ridges few and relatively large in the principal teeth, sometimes absent in the lateral teeth.

Form. & Loc. Coal-Measures: England, Scotland.

41211. Type specimen of *Climarodus ovatus*: Newsham, Newcastle-on-Tyne. *Presented by T. P. Barkas, Esq.*, 1868.

P. 3037. Tooth; Newsham. *Enniskillen Coll.*

P. 1371–2. Three teeth; Newsham. *Egerton Coll.*

P. 5233. Very large tooth: near Dudley, S. Staffordshire. *Purchased*, 1886.

P. 3036. One perfect dental crown detached from the matrix, and another embedded upon its anterior face: also two fragments; Carluke, Lanarkshire. *Enniskillen Coll.*

P. 3006. Three teeth probably of this species; Lowmoor, Yorkshire. *Enniskillen Coll.*

P. 1418. Two similar teeth; Lowmoor. *Egerton Coll.*

Janassa clavata (McCoy).

1843. *Chomatodus truncatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).
1855. *Chomatodus clavatus*, F. McCoy, Brit. Palæoz. Foss. p. 617, pl. 3 K. fig. 10.
1855. *Chomatodus truncatus*, F. M'Coy, *op. cit.* p. 618, pl. 3 I. fig. 1.
1883. *Petalodus acutus* (in part), J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 518.

Type. Detached tooth.

Teeth with extremely robust crowns. The basal coronal rugæ are few and insignificant, often entirely absent.

Form. & Loc. Carboniferous Limestone: England, Scotland, Ireland.

P. 2962, P. 2962 a. Twenty-five isolated teeth, one being nearly perfect and detached from the matrix; Armagh, Ireland. The tablet bears the original label, "Howse says this is allied to the genus *Janassa*." *Enniskillen Coll.*

P. 2962 b. Broad tooth, like No. 46036, showing delicate rugæ or folds at the base of the crown; Armagh. *Enniskillen Coll.*

P. 1462. Four similar teeth, named "*Chomatodus truncatus*" in Agassiz's handwriting; Armagh. *Egerton Coll.*

46036. Almost perfect tooth detached from matrix, showing no folds at the base of the crown, figured in Pl. I. fig. 3; Beith, Ayrshire. *Presented by Robert Craig, Esq.*, 1874.

49624-6, 49651. Four teeth, either of this or an allied species; Richmond, Yorkshire. *Purchased*, 1878.

Janassa imbricata (McCoy).

1848. *Climaxodus imbricatus*, F. McCoy, Ann. & Mag. Nat. Hist. [2] vol. ii. p. 129.

1855. *Climaxodus imbricatus*, F. McCoy, Brit. Palæoz. Foss. p. 620, pl. 3 G. fig. 5.

1870. *Janassa imbricata*, A. Hancock and T. Atthey, Nat. Hist. Trans. Northumb. & Durham, vol. iii. p. 338.

Type. Imperfect tooth.

Scarcely defined. The teeth are very similar to those of *J. clavata*, but differ in the prominence of the folds at the base of the crown. The original fragmentary tooth was misunderstood by McCoy, and the upper extremity described as the posterior, the hinder face of the crown as the grinding-surface.

Form. & Loc. Upper Carboniferous Limestone: Derbyshire.

P. 5339. Two teeth figured, nat. size, in Pl. I. figs. 1, 2. The larger specimen differs from the type in the same manner as the median teeth of *J. linguæformis* differ from those placed laterally in that species; its crown is much worn, apparently during the life of the animal. Ticknall, near Melbourne, South Derbyshire. *Wilson Coll.*

The following species have been recorded from the Permian of North America, the type specimens being detached teeth:—

Janassa strigilina, E. D. Cope, Amer. Nat. 1881, p. 163, and Trans. Amer. Phil. Soc. vol. xvi. (1887), p. 285: *Strigilina linguæformis*, E. D. Cope, Proc. Amer. Phil. Soc. vol. xvii. (1878), p. 52.—Eastern Illinois.

Janassa gurleiana, E. D. Cope, Amer. Nat. 1881, p. 163, and Trans. Amer. Phil. Soc. vol. xvi. (1887), p. 285; *Strigilina gurleiana*, Proc. Amer. Phil. Soc. vol. xvii. (1878), p. 191.—Danville, Illinois.

Janassa ordiana, E. D. Cope, Amer. Nat. 1881, p. 163, and Trans. Amer. Phil. Soc. vol. xvi. (1887), p. 285 (name only).—Texas.

The detached teeth described under the following names also appear to be referable to *Janassa*, as here defined:—

Climaxodus brevis, J. S. Newberry, Proc. Acad. Nat. Sci. Philad. 1856, p. 100.—Coal-Measures; Ohio.

Peltodus quadratus, O. St. John & A. H. Worthen, Pal. Illinois, vol. vi. (1875), p. 410, pl. xiii. figs. 6, 7.—St. Louis Limestone; Illinois, Missouri.

Peltodus (?) *plicamphodus*, St. John & Worthen, *tom. cit.* p. 411, pl. xiii. fig. 9.—Chester Limestone; Illinois.

Peltodus transversus, St. John & Worthen, *tom. cit.* p. 412, pl. xiii. fig. 8.—Coal-Measures; Illinois.

Peltodus magnificensis, Newberry & Worthen, Pal. Ill. vol. iv. (1870), p. 363, pl. ii. fig. 7.—U. Coal-Measures; Illinois.

Tanaodus bellicinctus, St. John & Worthen, *tom. cit.* p. 376, pl. xi. figs. 14–16, 25.—Chester Limestone; Illinois.

Tanaodus depressus, St. John & Worthen, *tom. cit.* p. 378, pl. xi. figs. 11–13.—Chester Limestone; Illinois.

Tanaodus grassiplicatus, St. John & Worthen, *tom. cit.* p. 375, pl. xi. fig. 26.—Chester Limestone; Illinois.

Tanaodus polymorphus, St. John & Worthen, *tom. cit.* p. 380, pl. xi. figs. 17–19, 24.—Chester Limestone; Illinois.

Tanaodus permutatus, St. John & Worthen, *tom. cit.* p. 371, pl. xi. figs. 6–10.—St. Louis Limestone; Illinois, Iowa, Missouri.

Tanaodus pumilus, St. John & Worthen, *tom. cit.* p. 369, pl. xi. figs. 1–5.—St. Louis Limestone; Illinois, Iowa.

Tanaodus sculptus, St. John & Worthen, *tom. cit.* p. 373, pl. xi. figs. 20–23.—St. Louis Limestone; Illinois, Iowa, Missouri.

Tanaodus subbicatus, St. John & Worthen, *tom. cit.* p. 368, pl. xi. fig. 27.—St. Louis Limestone; Illinois.

The genus and species *Thectodus engelianus*, Cope (Proc. Acad. Philad. 1883, p. 108), is founded upon fossils from the Permian of Illinois, evidently corresponding each to half of a bilateral tooth having the characters of that of *Janassa*. *Cymatodus oblongus*, Newberry & Worthen (Pal. Ill. vol. iv. p. 364, pl. iv. fig. 7), from the Coal-Measures of Illinois, also seems to be related to *Janassa*.

Genus **FISSODUS**, St. John & Worthen.

[Pal. Illinois, vol. vi. 1875, p. 413.]

Teeth very similar to those of *Janassa* and *Petalorhynchus*, but distinguished by the coronal margin being deeply cleft or divided into two or three broad, acuminate points.

Fissodus bifidus, St. John & Worthen, *tom. cit.* p. 414, pl. xiii. figs. 1, 2.—Chester Limestone; Illinois.

Fissodus pattoni, R. Etheridge, jun., Geol. Mag. [2] vol. iv. (1877), p. 306, pl. xiii. figs. 2, 3.—Lower Carboniferous Limestone; S. Scotland.

Fissodus tricuspidatus, St. John & Worthen, *tom. cit.* p. 415, pl. xiii. fig. 3.—Chester Limestone; Illinois.

The genus *Cholodus*, St. John & Worthen, *tom. cit.* p. 415, is founded upon imperfect teeth from the Upper Coal-Measures of Illinois and Iowa, resembling those of *Fissodus* very closely. The only described species is *C. inæqualis*, St. John & Worthen, *tom. cit.* p. 416, pl. xiii. figs. 4, 5.

Genus **PETALORHYNCHUS**, Newberry & Worthen (*ex* Agass. MS.).

[Pal. Illinois, vol. ii. 1866, p. 32.]

Teeth with crown compressed, thin, concavo-convex, petal-shaped, relatively high and narrow: basal imbricating folds few. The root is long, tapering, and undivided. The complete dentition consists of three or more parallel antero-posterior series, the crowns of the teeth in the median row being very high and narrow compared with those on either side.

Petalorhynchus psittacinus (McCoy).

1843. *Petalodus psittacinus*, L. Agassiz, Poiss. Foss. vol. iii. pp. 174, 384 (name only).

1843. *Petalodus sagittatus*, L. Agassiz, *tom. cit.* pp. 174, 384 (name only).

1855. *Petalodus psittacinus*, F. McCoy, Brit. Palæoz. Foss. p. 636, pl. 3 I. fig. 4.

1855. *Petalodus sagittatus*, F. McCoy, *op. cit.* p. 636, pl. 3 I. figs. 2, 3.

1862. *Petalorhynchus psittacinus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1881. *Petalorhynchus psittacinus*, J. W. Davis, Rep. Brit. Assoc. p. 646.

1883. *Petalorhynchus psittacinus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 516, pl. lxi. figs. 12–16.

1883. *Petalodus hastingsiæ*, J. W. Davis, *tom. cit.* p. 494, pl. lix. figs. 18, 20, 21.

1886. *Petalorhynchus psittacinus*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 149.

Type. Detached tooth.

Crown in the larger teeth produced into a sharp mesial point, and base extremely elongate and tapering.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland. Upper Carboniferous Limestone: Derbyshire, England.

Except where otherwise stated, the following specimens are from the Enniskillen Collection.

P. 2954–8. Specimens described and figured by J. W. Davis (*loc. cit.* 1883): Armagh. The tooth on the right of the specimen shown in fig. 15, pl. lxii. *l. c.*, was unfortunately missing when the collection reached the Museum, and is now only seen in impression.

P. 2995–7. Three unsymmetrical teeth, erroneously ascribed to *Petalodus hastingsiæ* by J. W. Davis, *loc. cit.*; Armagh.

P. 2961. Eleven series of teeth, similar to the original of fig. 16, *loc. cit.*; Armagh.

P. 2953. Sixty detached teeth in matrix, exhibiting anterior aspect; some are broken, some complete, showing variations of form; Armagh.

P. 2960. Twelve detached teeth, showing posterior aspect, and partly anterior; Armagh.

P. 2959. Fifteen very unsymmetrical lateral teeth; Armagh.

P. 1424. Twelve teeth, some broken; Armagh. *Egerton Coll.*

28731–2, 28737, 28919. Nine teeth, mostly broken; Armagh. *Purchased*, 1854.

Var. *minor*.

P. 5340. One perfect tooth, and four portions, detached from the matrix, only differing from the type specimens of *P. psittacinus* in their diminutive size. The perfect tooth is shown, twice nat. size, in Pl. I. fig. 9; Ticknall, near Melbourne, S. Derbyshire. *Wilson Coll.*

P. 5341. Connected series of four small teeth; Ticknall. *Wilson Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection :—

Petalorhynchus distortus, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 406, pl. xii. figs. 7, 8.—Upper St. Louis Limestone; Illinois, Iowa, Missouri.

Petalorhynchus indicus, W. Waagen, Pal. Ind. ser. 13, pt. i. (1879), p. 17, pl. i. fig. 8.—Productus Limestone; Salt Range, India. (? *Janassa*.)

Petalorhynchus pseudosagittatus, St. John & Worthen, *tom. cit.* p. 405, pl. xii. figs. 1–4.—Upper St. Louis Limestone; Illinois, Iowa, Missouri.

Petalorhynchus spatulatus, St. John & Worthen, *tom. cit.* p. 408, pl. xii. figs. 5, 6.—Upper St. Louis Limestone; Illinois, Iowa.

Petalorhynchus striatus, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 40, pl. ii. fig. 8.—Burlington Limestone; Illinois.

Genus **PETALODUS**, Owen.

[Odontography, 1840–45, p. 61.]

Syn. *Chomatodus*, L. Agassiz (in part), Poiss. Foss. vol. iii. 1838, p. 108.
Antliodus, Newberry & Worthen, Pal. Illinois, vol. ii. 1866, p. 33.
Sicarius, J. Leidy, Proc. Acad. Nat. Sci. Philad. vol. vii. 1856, p. 414.

Teeth much transversely elongated and compressed. The crown is petal-shaped, with a smooth or delicately crenulated margin. In the typical species the root is relatively large, though in some ("*Antliodus*" and "*Chomatodus*") comparatively short; it is tumid and truncated at its lower extremity.

Petalodus acuminatus (Agass.).

1838. *Chomatodus acuminatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 108, pl. 19. figs. 11–13.

1840–45. *Petalodus hastingsii*, R. Owen, Odontogr. p. 61, pl. xxii. figs. 3–5.

1843. *Petalodus acuminatus*, L. Agassiz, *tom. cit.* pp. 174, 384.

(?) 1843. *Petalodus hastingsii*, J. E. Portlock, Rep. Geol. Londonderry, p. 408, pl. xiv. fig. 10.

1848. *Petalodus rhombus*, F. McCoy, Ann. & Mag. Nat. Hist. [2] vol. ii. p. 125.

1855. *Petalodus acuminatus*, F. McCoy, Brit. Palæoz. Foss. p. 635, pl. 3 G. fig. 4.

(?) 1878. *Petalodus hastingsiæ*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. p. 50, pl. vi. figs. 6–8.

1883. *Petalodus acuminatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 494, pl. lix. figs. 22–24.

1883. *Petalodus inequilateralis*, J. W. Davis, *tom. cit.* p. 497, pl. lx. figs. 3, 4.

1884. *Petalodus acuminatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 624, pl. xxvi. fig. 10.

Type. Detached tooth.

Margin of the crown in the median rows of teeth more or less acuminate, the apex being either sharp or rounded; the anterior face is approximately rhombic in form.

Form. & Loc. Upper Carboniferous Limestone: Durham, Yorkshire, and Derbyshire, in England; Fifeshire and Ayrshire, in Scotland.

P. 613. Fragment described by Owen, *loc. cit.*, as *P. hastingsii*; Ticknall, South Derbyshire. *Egerton Coll.*

P. 5342. Twenty-five teeth, variously broken and abraded; Ticknall. Four of these are shown in Pl. I. figs. 4–7, and, as all the specimens were obtained from the same bed and at the same spot as the type of *P. hastingsii*, Owen, the latter is thus proved to be identical with Agassiz's *P. acuminatus*. Many of the teeth (*e. g.* fig. 5) are of the same form as the Yorkshire specimens named *P. inequilateralis* by Davis. *Wilson Coll.*

P. 261. Worn tooth in matrix; Derbyshire. *Purchased*, 1880.

46816–7. Two small teeth and one larger. The latter is considerably broken, but has a remarkably short root. The small teeth are apparently distinguished from those found in the Armagh limestone by the relatively greater extent of the posterior face of the crown occupied by the basal folds; Derbyshire. *Gilbertson Coll.*

P. 2986. Specimen figured in Trans. Roy. Dublin Soc. [2] vol. i. pl. lix. fig. 24; Richmond, Yorkshire. *Enniskillen Coll.*

P. 2987. Twelve teeth from the same formation and locality, variously broken and abraded. One is of the type of "*P. inequilateralis.*" *Enniskillen Coll.*

P. 1420, P. 1425. Eleven specimens; Richmond. *Egerton Coll.*

35472–6, 35478–80, 35482, 36884, 36887, 49612. Twelve specimens: Richmond. *Purchased*, 1860, 1862, 1878.

P. 4899. Three teeth; Wensleydale, Yorkshire. *Horne Coll.*

P. 2990. Type specimens of *P. inequilateralis*, Davis: Richmond. *Enniskillen Coll.*

P. 2991. Two similar, but less perfect, unsymmetrical lateral teeth; Yoredale, Yorkshire. *Enniskillen Coll.*

35477, 35481. Two similar teeth; Richmond. *Purchased*, 1860.

39926, P. 1421. Incomplete crown (*Purchased*, 1866) and broken fragment (*Egerton Coll.*); Settle, Yorkshire.

46035. Four teeth in matrix; Beith, Ayrshire. *Presented by Robert Craig, Esq.*, 1874.

P. 258. Two teeth in matrix; Beith. *Purchased*, 1880.

P. 2988. Tooth in matrix; Ladedda, Fifeshire. *Enniskillen Coll.*

Petalodus hastingsiæ, McCoy (*non* Owen).

1843. *Petalodus hastingsiæ*, L. Agassiz, Poiss. Foss. vol. iii. pp. 174, 384 (name only).
1843. *Petalodus lævissimus*, L. Agassiz, *tom. cit.* pp. 174, 384 (name only).
1855. *Petalodus hastingsii*, F. McCoy, Brit. Palæoz. Foss. p. 635.
1875. *Petalodus hastingsiæ*, W. H. Baily, Figs. Char. Brit. Foss. p. 120, pl. xli. fig. 13.
1883. *Petalodus hastingsiæ*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 493, pl. lix. figs. 16, 17, 19 (*non* figs. 18, 20, 21).
1886. *Petalodus hastingsiæ*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 149.

Type. Detached teeth.

A comparatively small species, none of the typical teeth having a greater transverse measurement than 0·018 m. The margin of the crown of the principal teeth is almost always gently rounded; that of the lateral teeth shows more tendency towards an acuminate form. The basal coronal folds generally occupy a relatively less space upon the posterior aspect of the tooth than in *P. acuminatus*.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Tyrone, Ireland. Upper Carboniferous Limestone: Derbyshire (*Davis*), (?) Yorkshire, Northumberland (*McCoy*), England.

P. 2992–4. Three teeth described and figured by J. W. Davis, *loc. cit.*; Armagh. *Enniskillen Coll.*

P. 2998. About twenty-six teeth; Armagh. *Enniskillen Coll.*

P. 1422. Fourteen teeth; Armagh. *Egerton Coll.*

28733, 28922, 38504. Twelve teeth; Armagh. *Purchased*, 1854, 1864.

P. 2999. Six teeth, either of this species, or lateral teeth and young of *P. acuminatus*; Richmond, Yorkshire.

Enniskillen Coll.

P. 3007. Fragmentary tooth, doubtfully of this species: Bristol.

Enniskillen Coll.

Petalodus grandis, Davis.

1883. *Petalodus grandis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 496, pl. lx. fig. 1.

Type. Much broken tooth; British Museum.

This name is given to a unique tooth of very large size (No. **P. 2985**) in the Enniskillen Collection.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

Petalodus flabellula, sp. nov.

Type. Detached tooth, shown of nat. size in Pl. I. fig. 8.

Crown comparatively high, having the posterior face (probably also the anterior) marked by large vertical and slightly diverging wrinkles; coronal margin very gently arched, faintly crenulated.

Form. & Loc. Carboniferous Limestone: Oreton, Shropshire.

P. 227 a. Type specimen. *Weaver Jones Coll.*

42219. Fragment of less abraded tooth. *Baugh Coll.*

Petalodus linearis (Agassiz).

1838. *Chomatodus linearis*, L. Agassiz, Poiss. Foss. vol. iii. p. 108, pl. xii. figs. 6, 9, 10, ? figs. 5, 11 (*non* figs. 7, 8, 12, 13).

Type. Detached teeth; Bristol Museum.

Teeth extremely elongated. The margin of the crown is arched, though scarcely tapering, at either extremity in the principal teeth; anterior and posterior faces nearly equal; coronal surface smooth. The root is very short, not deeper than the crown.

It is uncertain whether the tooth shown in Agassiz's fig. 5 pertains to this species, the crown more approximating in form to *P. hastingsiæ*. This specimen is referred to "*Antliodus*" by Newberry and Worthen[1].

Many of the teeth commonly associated with this species may be provisionally referred to *Helodus*. Such are the originals of Agassiz's figs. 7, 8, 12, 13, and one described and figured by Davis[2];

[1] Pal. Illinois, vol. ii. p. 52.

[2] Trans. Roy. Dublin Soc. [2] vol. i. p. 508, pl. lxi. fig. 1.

the homologous parts of the latter are misinterpreted, the apical edge being regarded as the anterior coronal margin, and the posterior half of the coronal face as a portion of the root. It must, however, be admitted that at this point there is no very philosophical line of distinction between the teeth named *Helodus* and the Petalodonts.

Form. & Loc. Lower Carboniferous (Bone-bed in Lower Limestone Shales): Bristol, England.

P. 2652. Four teeth; Bristol. One of these specimens is unsymmetrical, evidently having been laterally placed.
Enniskillen Coll.

P. 1464. Three teeth; Bristol. *Egerton Coll.*

Petalodus davisii, sp. nov.

Type. Detached teeth; British Museum.

Teeth extremely elongated, very similar to those of *P. rectus*, but somewhat smaller and even longer in proportion to their height; coronal surface with numerous vertical wrinkles and a tendency towards crenulation of the margin; root considerably crimped.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2656 a, P. 2656. Two type specimens and sixteen similar teeth.
Enniskillen Coll.

P. 1463. Similar imperfect tooth; Armagh. *Egerton Coll.*

A larger imperfect tooth (**P. 5456**) from the Upper Carboniferous Limestone of Richmond, Yorkshire, seems to indicate a species allied to the foregoing; and another fragmentary tooth (**P. 2913**, *Enniskillen Coll.*), from the Lower Carboniferous Limestone of Armagh, has been described by Davis (Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 509, pl. lxi. fig. 2) under the name of *Chomatodus acutus*.

Petalodus alleghaniensis, Leidy.

1856. *Sicarius extinctus*, J. Leidy, Proc. Acad. Nat. Sci. Philad. vol. vii. p. 414.

1856. *Petalodus alleghaniensis*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. iii. p. 161, pl. xvi. figs. 4–6. [Specific name, *extinctus*, withdrawn.]

1866. *Petalodus destructor*, J. S. Newberry & A. H. Worthen, Pal. Illinois, vol. ii. p. 35, pl. ii. figs. 1–3.

1870. *Petalodus destructor*, O. St. John, Proc. Amer. Phil. Soc. vol. xi. p. 433.

1872. *Petalodus destructor*, O. St. John, Final Rep. U.S. Geol. Surv. Nebraska, p. 241, pl. iii. fig. 5.

1873. *Petalodus alleghaniensis*, J. Leidy, Extinct Vert. Fauna West. Territ. (Rep. U.S. Geol. Surv. Territ., 1873), p. 312, pl. xvii. fig. 3.

1875. *Petalodus alleghaniensis*, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. p. 52, pl. lviii. fig. 13.

Type. Detached tooth.

Crown of tooth acuminate, much projecting beyond the root anteriorly. Lateral margin of the root sharply bent at one third the distance from its tapering, but truncate, extremity.

Form. & Loc. Coal-Measures: Pennsylvania, Ohio, Arkansas, Illinois, Nebraska, U.S.A.

H. Trautschold[1] has also recorded this species from the Carboniferous Limestone of Mjatschkowa, near Moscow; but the determination is extremely doubtful.

35678. Fine tooth from Turkey Creek, Conway Co., Arkansas. *Purchased*, 1859.

P. 2981. Crown and portion of root: La Salle, Illinois. *Enniskillen Coll.*

Some abraded and fragmentary teeth (Nos. **P. 4885, 4907**, *Purchased*, 1885) from the Yoredale Rocks of Wensleydale, Yorkshire, resemble the fossils described by J. W. Davis[2] as *Glyphanodus tenuis*. Upon present evidence, however, these cannot be distinguished from worn fragments of *Petalodus*.

The following species, referable to *Petalodus* as here defined, have been founded upon detached teeth, but only three appear to be represented in the Collection: these are from the Enniskillen Collection, Nos. **P. 2983** (*P. parvulus*), **P. 2980** (*A. sulcatus*), and **P. 2984** (*A. politus*):—

Petalodus curtus, Newberry & Worthen, Pal. Illinois, vol. iv. (1870), p. 355, pl. iii. fig. 2.—Keokuk Limestone; Illinois.

Petalodus hybridus, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 394, pl. xii. fig. 10.—St. Louis Limestone; Illinois.

Petalodus knappi, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1879, p. 345.—Keokuk Limestone; Indiana.

Petalodus linguifer, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 37, pl. ii. figs. 4, 5.- Chester Limestone; Illinois.

Petalodus "new variety," W. J. Barkas, Monthly Rev. Dental

[1] Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. 1879, p. 56, pl. vii. figs. 13, 14.

[2] Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 386, pl. xlv. figs. 24, 25; and Quart. Journ. Geol. Soc. vol. xl. (1884), p. 621, pl. xxvii. fig. 8.

Surgery, vol. ii. (1874) p. 537, figs. xxvii, xxviii.—Coal-Measures; Northumberland.

Petalodus parvulus: *Antliodus parvulus*, Newberry & Worthen, *op. cit.* vol. ii. p. 38, pl. ii. fig. 7.—Burlington and Keokuk Limestones; Illinois.

Petalodus proximus, St. John & Worthen, *tom. cit.* p. 395, pl. xii. fig. 11.—Upper Coal-Measures; Illinois.

Antliodus cucullus, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 41, pl. iii. fig. 1.—Keokuk Limestone; Illinois.

Antliodus gracilis, St. John & Worthen, *op. cit.* vol. vi. (1875), p. 393, pl. xi. fig. 29.—Warsaw Beds; Illinois.

Antliodus minutus, Newberry & Worthen, *op. cit.* vol. ii. p. 43, pl. iii. fig. 3; J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1879, p. 341.—Keokuk Limestone, Illinois: St. Louis Limestone, Indiana. ?Also *A. minutus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 52, pl. vi. fig. 9.—Lower Carboniferous Limestone (Bed *Ie*); Tournai, Belgium.

Antliodus mucronatus, Newberry & Worthen, *op. cit.* vol. ii. p. 38, pl. ii. fig. 6.—St. Louis Limestone; Illinois.

Antliodus perovalis, St. John & Worthen, *op. cit.* vol. vi. p. 393, pl. xi. fig. 28.—Warsaw Beds; Illinois.

Antliodus politus, Newberry & Worthen, *op. cit.* vol. ii. p. 42, pl. iii. fig. 2.—Keokuk Limestone; Illinois.

Antliodus robustus, Newberry & Worthen, *op. cit.* vol. ii. p. 39, pl. ii. fig. 9.—Chester Limestone; Illinois.

Antliodus similis, Newberry & Worthen, *op. cit.* vol. ii. p. 41, pl. ii. fig. 10. ?Also J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1879, p. 346.—Keokuk Limestone; Illinois, (?) Indiana.

Antliodus simplex, Newberry & Worthen, *op. cit.* vol. ii. p. 44, pl. iii. fig. 4.—Burlington Limestone; Iowa.

Antliodus sulcatus, Newberry & Worthen, *op. cit.* vol. ii. p. 45, pl. iii. fig. 5.—Keokuk Limestone; Illinois.

Chomatodus affinis, Newberry & Worthen, *op. cit.* vol. ii. p. 54, pl. iii. fig. 15.—Keokuk Limestone; Illinois.

Chomatodus angularis, Newberry & Worthen, *op. cit.* vol. ii. p. 55, pl. iii. fig. 16.—Coal-Measures; Illinois.

Chomatodus cultellus, Newberry & Worthen, *op. cit.* vol. ii. p. 52, pl. iii. fig. 13.—Chester Limestone; Illinois.

Chomatodus gracillimus, Newberry & Worthen, *op. cit.* vol. ii. p. 51, pl. iii. fig. 12.—Burlington Limestone; Iowa.

Chomatodus insignis (Leidy), St. John & Worthen, *op. cit.* vol. vi. pl. x. A. fig. 5: (?) *Palæobatis insignis*, J. Leidy, Trans. Amer.

Phil. Soc. [2] vol. xi. (1857), p. 89, pl. v. figs. 24–26.—Lower Carboniferous. Illinois; and St. Louis Limestone, Missouri.

Chomatodus lamelliformis, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. (1884), p. 625, pl. xxvii. fig. 23.—Yoredale Rocks; Wensleydale, Yorkshire.

Chomatodus lirijormis, Newberry & Worthen, *op. cit.* vol. ii. p. 58, pl. iii. fig. 19.—Keokuk Limestone; Illinois.

Chomatodus molaris, Newberry & Worthen, *op. cit.* vol. ii. p. 56, pl. iii. fig. 17.—Keokuk Limestone; Illinois.

Chomatodus multiplicatus, Newberry & Worthen, *op. cit.* vol. ii. p. 57, pl. iii. fig. 18.—Burlington Limestone; Iowa. ?Also *Tamiodus multiplicatus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. 1878, p. 53, pl. vi. figs. 10, 11.—Lower Carboniferous Limestone; Tournai.

Chomatodus parallelus, St. John & Worthen, *op. cit.* vol. vi. p. 358, pl. x. a. figs. 3, 4.—Warsaw Beds; Illinois, Missouri.

Chomatodus pusillus, Newberry & Worthen, *op. cit.* vol. ii. p. 53, pl. iii. fig. 14.—Keokuk Limestone; Illinois.

Chomatodus sarcululus, Newberry & Worthen, *op. cit.* vol. iv. p. 356, pl. ii. fig. 8.—Burlington Limestone; Iowa.

The genus *Lisgodus*, St. John & Worthen (*op. cit.* vol. vi. 1875, p. 363), is difficultly definable from *Petalodus*. Four species are described—*L. curtus* (*tom. cit.* p. 364, pl. x. a. figs. 20–22), *L. sellaliformis* (*tom. cit.* p. 366, pl. x. a. fig. 16), *L. serratus* (*tom. cit.* p. 365, pl. x. a. figs. 17–19), and *L. affinis* (J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1879, p. 343). The first and third are from the Upper Burlington Limestone, Illinois and Iowa; the second and fourth from the Upper St. Louis Limestone, Illinois and Missouri.

Closely allied also is the genus *Calopodus*, St. John & Worthen, represented by the single species *C. apicalis*, St. J. & W. (Pal. Ill. vol. vi. 1875, p. 403, pl. xii. figs. 16, 17), from the Middle Coal-Measures of Iowa.

Genus **CTENOPTYCHIUS**, Agassiz.

[Rech. Poiss. Foss. vol. iii. 1838, p. 99.]

Syn. *Ctenopetalus*, J. W. Davis (*ex* Agass. MSS.), Ann. & Mag. Nat. Hist. [5] vol. viii. 1881, p. 426.

Harpacodus, J. W. Davis (*ex* Agass. MSS.), *loc. cit.* p. 426.

Serratodus, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. 1878, p. 53.

Peripristis, O. St. John, Proc. Amer. Phil. Soc. vol. xi. 1870, p. 434.

Petalodopsis, J. W. Davis (*non* W. J. Barkas), Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 498.

Teeth as in *Petalodus*, but having the coronal margin coarsely denticulated.

Ctenoptychius apicalis, Agassiz.

1838. *Ctenoptychius apicalis*, L. Agassiz, Poiss. Foss. vol. iii. p. 99, pl. xix. fig. 1.
1841. *Ctenoptychius apicalis*, E. W. Binney, Trans. Manchester Geol. Soc. vol. i. p. 169, pl. v. fig. 19.
1873. *Ctenoptychius apicalis*, T. P. Barkas, Coal Meas. Palæont. p. 18, pl. i. fig. 21.
1874. *Ctenoptychius apicalis*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. ii. pp. 443, 482, figs. xiv., xv.
1874. *Petalodus apicalis*, W. J. Barkas, *tom. cit.* p. 538.
1875. *Ctenoptychius apicalis*, J. Ward, [Proc. North Staffs. Nat. Field-Club, p. 218, fig. 12.

Type. Detached tooth; British Museum.

Teeth with coronal margin acuminate, divided into few (5–9) relatively large, smooth, but pointed denticulations; anterior base-line of the crown slightly curved. In the principal teeth the median denticulation is prominent and much the largest. Root markedly tumid below, truncate.

Form. & Loc. Coal-Measures: Lanarkshire, Scotland; Northumberland, Yorkshire, Lancashire, Staffordshire, England.

P. 496. Type specimen; Silverdale, Staffordshire. *Egerton Coll.*

P. 3020, P. 3023. Seven teeth, variously broken and abraded; New Ironstone (Rag-mine), Fenton, N. Staffordshire. *Enniskillen Coll.*

P. 1458, P. 1460 1. Six teeth; Fenton. *Egerton Coll.*

34995–7, P. 246. Four teeth; Fenton. *Purchased*, 1860, 1880.

P. 5167–8. Three portions of teeth; Fenton. *Purchased*, 1885.

46028. Crown of tooth; Longton, N. Staffordshire. *Presented by John Ward, Esq.*, 1874.

P. 3022. Fine tooth; Harecastle, N. Staffordshire. *Enniskillen Coll.*

P. 1459. Tooth; Lowmoor, Yorkshire. *Egerton Coll.*

P. 3021. Three teeth; Carluke, Lanarkshire. *Enniskillen Coll.*

21423. Tooth; Carluke. *Purchased*, 1847.

Ctenoptychius dentatus (Owen).

1843. *Ctenoptychius dentatus*, L. Agassiz, Poiss. Foss. vol. iii. pp. 173, 383 (name only).
1843. *Ctenoptychius macradus*, L. Agassiz, *tom. cit.* pp. 173, 383 (name only).
1840–45. *Petalodus dentatus*, R. Owen, Odontography, vol. i. p. 62.
1843. *Ctenoptychius macradus*, J. E. Portlock, Rep. Geol. Londond. p. 467, pl. xiv. fig. 7 (inaccurate figure).
1862. *Harpacodus dentatus*, J. Morris & G. E. Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).
1881. *Harpacodus dentatus*, J. W. Davis, Ann. & Mag. Nat. Hist. [5] vol. viii. p. 426.
1883. *Harpacodus dentatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 514, pl. lxi. fig. 10.

Type. Detached tooth; (?) British Museum[1].

Margin of dental crown not acuminate, divided into few (about 5–7) relatively large, smooth, pointed denticulations: anterior base-line of crown gently curved. In the principal teeth the median denticulation is scarcely larger than those immediately adjoining. Root markedly tumid below, truncate.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 3008. Tooth described and figured by J. W. Davis, *loc. cit.* *Enniskillen Coll.*

P. 3009. Twenty-two teeth. *Enniskillen Coll.*

P. 1441. Six teeth. *Egerton Coll.*

28926, 28736. Ten teeth. *Purchased*, 1854.

Ctenoptychius lobatus (Etheridge).

1875. *Petalodus? lobatus*, R. Etheridge, jun., Geol. Mag. [2] vol. ii. p. 244, pl. viii. figs. 5, 6.
1883. *Ctenopetalus crenatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 513, pl. lxi. fig. 9 (broken tooth).
1884. *Ctenopetalus crenatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 623, pl. xxvii. fig. 18.

Type. Detached tooth; coll. James Bennie.

Margin of dental crown acuminate. Denticulations in principal teeth about 9–13 in number, smooth and pointed, but appearing as if crenulated when worn: those of the unsymmetrical lateral teeth more numerous and obtuse. Anterior base-line of crown sharply

[1] An unmarked specimen in Admiral Jones's collection, either in the Museum or in the possession of the Geological Society.

angulated. Root elongated, and produced to a blunt point in the principal teeth.

In the last-named character *C. lobatus* bears the same relation to the other species of the genus that is borne by *Petalodus alleghaniensis* to the remaining species of its genus.

Form. & Loc. Lower Carboniferous Limestone: Lanarkshire. Upper Carboniferous Limestone: Yorkshire, Derbyshire.

P. 5342. Nine principal teeth, variously broken, detached from matrix: Ticknall, S. Derbyshire. One specimen, occupying apparently a median position in the mouth, is shown, twice nat. size, in Pl. I. fig. 12. *Wilson Coll.*

P. 5343. Seven very unsymmetrical lateral teeth, detached from matrix, with numerous obtuse denticulations; Ticknall. Two specimens are shown, twice nat. size, in Pl. I. figs. 10, 11. *Wilson Coll.*

P. 3005. Five teeth, more or less broken, embedded in matrix; Yoredale Rocks, Wensleydale, Yorkshire. *Enniskillen Coll.*

P. 4889. Two teeth with imperfect roots, one detached from matrix; Wensleydale. *Horne Coll.*

Ctenoptychius serratus (Owen).

1843. *Ctenoptychius serratus*, L. Agassiz, Poiss. Foss. vol. iii. pp. 173, 383 (name only).

1840-45. *Petalodus serratus*, R. Owen, Odontography, vol. i. p. 62.

1855. *Ctenoptychius serratus*, F. McCoy, Brit. Palæoz. Foss. p. 626, pl. 3 I. figs. 21-23.

1862. *Ctenopetalus serratus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).

1881. *Ctenopetalus serratus*, J. W. Davis, Ann. & Mag. Nat. Hist. [5] vol. viii. p. 426.

1883. *Ctenopetalus serratus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 512, pl. lxi. figs. 6-8.

Type. Detached tooth; Jones Collection.

Margin of crown acuminate in principal teeth, often gently rounded in others. Denticulations large, truncate, often incompletely separated, and crenulated at the summit. Anterior base-line of crown sharply curved. Root obtuse.

This species connects the typical dentition of *Ctenoptychius* with that of *Petalodus*. The coronal denticulations are sometimes only evident at the extremities of the tooth, where they are merely divided by short vertical folds.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland. Carboniferous Limestone: Shropshire (*Davis*). Derbyshire (*McCoy*).

P. 3000–2. Specimens figured by J. W. Davis, Trans. Roy. Dublin Soc. *loc. cit.*; **Armagh.** *Enniskillen Coll.*

P. 3003. Twenty teeth; Armagh. *Enniskillen Coll.*

P. 3004. Twelve teeth; Tynan, Armagh. *Enniskillen Coll.*

P. 1443. Six teeth; Armagh. *Egerton Coll.*

28538, 28735, 28921, 28927, 38504. Twenty-two broken teeth; **Armagh.** *Purchased.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Ctenoptychius acuminatus: *Pristodus? acuminatus*, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 402, pl. x. A. fig. 6. —Kinderhook Limestone; Iowa.

Ctenoptychius bellulus: *Ctenopetalus bellulus*, St. John & Worthen, *tom. cit.* p. 398, pl. xii. fig. 9.—St. Louis Limestone: Iowa, Illinois.

Ctenoptychius compactus: *Harpacodus compactus*, St. John & Worthen, *tom. cit.* p. 355, pl. x. A. fig. 1.—Chester Limestone; Illinois.

Ctenoptychius elegans: *Serratodus elegans*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 54, pl. vi. fig. 12.—U. Carboniferous Limestone; Visé, Belgium.

Ctenoptychius limatulus: *Ctenopetalus limatulus*, St. John & Worthen, *tom. cit.* p. 399, pl. xii. fig. 18.—Chester Limestone; Illinois.

Ctenoptychius medius: *Ctenopetalus medius*, St. John & Worthen, *tom. cit.* p. 400, pl. x. A. fig. 26.—Chester Limestone: Illinois.

Ctenoptychius occidentalis[1]: *Ctenopetalus occidentalis*, St. John & Worthen, *tom. cit.* p. 401, pl. xii. fig. 14.—Lower Coal-Measures; Iowa.

Ctenoptychius pertenuis, St. John & Worthen, *tom. cit.* p. 382, pl. x. A. fig. 27.—Chester Limestone; Illinois.

Ctenoptychius semicircularis, Newberry & Worthen, Pal. Illinois,

[1] If, as the present writer considers, the tooth described by St. John & Worthen (*tom. cit.* p. 355, pl. x. A. fig. 2) as *Harpacodus occidentalis* must be placed in *Ctenoptychius* and if these two species are distinct from all others, one will require a new specific name.

vol. ii. (1866), p. 72, pl. iv. fig. 18; *Peripristis semicircularis*, O. St. John, Final Rep. U. S. Geol. Surv. Nebraska, 1872, p. 242, pl. iii. figs. 3, 4, pl. iv. fig. 20; *Ctenoptychius semicircularis*, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. (1875), p. 52, pl. lviii. fig. 14.—Coal-Measures; Indiana, Ohio, Nebraska.

Ctenoptychius stevensoni, St. John & Worthen, *tom. cit.* p. 383, pl. xii. fig. 15.—Coal-Measures; West Virginia.

Ctenoptychius tripartitus: *Petalodopsis tripartitus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 499, pl. lx. fig. 6; and Quart. Journ. Geol. Soc. vol. xl. (1884), pl. xxvi. fig. 16.—U. Carboniferous Limestone; Wensleydale, Yorkshire.

Ctenoptychius vinosus: *Ctenopetalus vinosus*, St. John & Worthen, *tom. cit.* p. 396, pl. xii. fig. 13.—Keokuk Limestone; Iowa.

An indeterminable ichthyolite, from the Scotch Old Red Sandstone, has been described as *Ctenoptychius priscus* by Agassiz, Poiss. Foss. V. Grès Rouge, 1844, p. 124. An unsatisfactory fossil, from the Rhætic Beds of Aust Cliff, near Bristol, also appears to form the type of *Ctenoptychius ordii*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. (1881), p. 422, pl. xxii. fig. 8.

A form of tooth, from the Northumbrian Coal-Measures, very suggestive of *Ctenoptychius*, was described under the name of *Petalodopsis mirabilis* by W. J. Barkas, Monthly Rev. Dental Surgery, vol. ii. (1874), p. 538, figs. xxx.–xxxii., and vol. iii. p. 4, figs. xxxiii.–xxxv. More recent researches, however, have shown that this is probably the vomerine tooth of *Ctenodus*[1].

Genus **CALLOPRISTODUS**, Traquair.

[Geol. Mag. [3] vol. v. 1888, p. 85.]

Syn. *Ctenoptychius*, L. Agassiz (in part.).

Teeth with low crown, coarsely denticulated, having no folds at its base-line, which is straight both in front and behind. Root very long, fibrous, often divided below into a number of small irregular "rootlets."

W. J. Barkas[2] has pointed out that the microscopical structure of the type species of this genus, *C. pectinatus*, is very different from

[1] See W. J. Barkas, Proc. Roy. Soc. New South Wales, vol. x. (1876), p. 115, figs. xiv.–xix. Also T. Atthey, Ann. & Mag. Nat. Hist. [4] vol. xv. (1875), p. 310, pl. xix. fig. 4.

[2] Monthly Rev. Dental Surgery, vol. ii. (1874), pp. 482, 538.

that of *Ctenoptychius apicalis*, the latter more approaching *Petalodus*. Since, however, it seems advisable to retain *Ctenoptychius*, Agassiz, as a genus distinct from *Petalodus*, *C. pectinatus* must henceforth be quoted under the recently proposed generic name of *Callopristodus*.

Callopristodus pectinatus (Agassiz).

1838. *Ctenoptychius pectinatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 100, pl. 19. figs. 2–4.

1838. *Ctenoptychius denticulatus*, L. Agassiz, *tom. cit.* p. 101, pl. 19. figs. 5–7.

1841. *Ctenoptychius pectinatus*, E. W. Binney, Trans. Manchester Geol. Soc. vol. i. p. 169, pl. v. figs. 20, 21.

1867. *Agelodus diadema*, R. Owen, Trans. Odontol. Soc. vol. v. p. 340, pl. iv.

1870. *Ctenoptychius pectinatus*, A. Hancock & T. Atthey, Nat. Hist. Trans. Northumb. & Durham, vol. iii. p. 115.

1873. *Ctenoptychius pectinatus*, T. P. Barkas, Coal Meas. Palæont. p. 18, pl. i. figs. 17–19.

1874. *Ctenoptychius pectinatus*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. ii. p. 440, figs. xiii., xviii., xix.

1874. *Ctenoptychius denticulatus*, W. J. Barkas, *tom. cit.* p. 441.

1882. *Ctenoptychius pectinatus*, T. Stock, Ann. & Mag. Nat. Hist. [5] vol. ix. p. 256, pl. viii. figs. 5–17.

1888. *Callopristodus pectinatus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 85.

Type. Detached teeth; coll. Royal Society of Edinburgh.

Margin of dental crown not acuminate; denticulations sharply pointed.

Form. & Loc. Lower Carboniferous: Scotch Coalfield. Coal-Measures: Northumberland, Yorkshire, Lancashire, Staffordshire.

The occurrence of this species in the Rhætic Bone-bed of Aust, recorded by J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. p. 424, must be regarded as extremely doubtful.

50096. Two teeth; Calciferous Sandstone, Burdiehouse, Edinburgh. *Purchased*, 1879.

P. 4494. Eleven teeth; Blackband Ironstone, Edge Coal Series, Borough Lee, Edinburgh.
Presented by Ramsay H. Traquair, Esq., M.D., 1884.

41197, 45901. Seven teeth; probably from Borough Lee.
Purchased, 1868, 1874.

41196, 41734. Six teeth: Coal-Measures, Newcastle-on-Tyne.
Purchased, 1868, 1869.

41204. Four teeth; Newcastle-on-Tyne.
Presented by T. P. Barkas, Esq., 1868.

P. 5289. Two teeth: West Cramlington, near Newcastle-on-Tyne.
Presented by Sir Richard Owen, K.C.B., 1884.

34998–9, P. 5169. Four teeth: Upper Coal-Measures (New Ironstone—Rag-mine), Fenton, North Staffordshire.
Purchased.

P. 1456. Four teeth; Fenton. *Egerton Coll.*

P. 3017–19. Eight teeth: Fenton. *Enniskillen Coll.*

P. 1457. Impression of tooth very similar to those of this species; Coal-Measures, Nova Scotia. *Egerton Coll.*

Teeth slightly differing from those of *C. pectinatus* are described from the Coal-Measures of Nova Scotia under the name of *Ctenoptychius cristatus*, J. W. Dawson, Acadian Geology, 3rd edit. 1878, p. 209, woodcut. It is possible that the imperfect fossil last named (**P. 1457**) may be truly referable to this species.

With *Calloprislodus* may also be placed the unique tooth from the Northumbrian Coal-Measures, described under the name of *Ctenoptychius aciculatus* by W. J. Barkas, Monthly Rev. Dental Surgery, vol. ii. (1874), p. 533, figs. xxiv.–xxvi.

Genus **POLYRHIZODUS**, McCoy.

[Ann. & Mag. Nat. Hist. [2] vol. ii. 1848, p. 125.]

Syn. *Dactylodus*, Newberry & Worthen, Pal. Illinois, vol. ii. 1866, p. 33.

Teeth very robust, with crown but slightly elevated and more adapted for crushing than cutting. The edge of the crown is generally sharp, but rarely crenulated; its base is marked by one, two, or three ridges. The root is large, and deeply divided into several distinct, root-like lobes or fangs.

No teeth of *Polyrhizodus* have hitherto been discovered in natural association, and it is thus impossible to distinguish between specific characters and the variations exhibited by the teeth in different parts of a single jaw. It seems certain that most of the so-called specific differences belong to the latter category; but since the various types have unfortunately received names, and as there is yet no absolute *proof* of their pertaining to one or any definite number of species, it is considered convenient to adopt this provisional arrangement.

Polyrhizodus magnus, McCoy [1].

1843. *Petalodus radicans*, L. Agassiz, Poiss. Foss. vol. iii. pp. 174, 384 (name only).

1848. *Polyrhizodus magnus*, F. McCoy, Ann. & Mag. Nat. Hist. [2] vol. ii. p. 126.

1855. *Polyrhizodus magnus*, F. McCoy, Brit. Palæoz. Foss. p. 641, pl. 3 K. figs. 6–8.

1883. *Polyrhizodus radicans*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 500, pl. lx. figs. 7, 8.

1883. *Polyrhizodus constrictus*, J. W. Davis, *tom. cit.* p. 506, pl. lx. fig. 15.

Type. Detached tooth.

Crown of teeth moderately high, with the base-line curved both in front and behind. "Rootlets" six to eight in number, each generally divided again into two.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2963–4. Specimens figured by J. W. Davis, *loc. cit.* *Enniskillen Coll.*

P. 2965. Twenty-three specimens. *Enniskillen Coll.*

P. 2978. Seven specimens; Tynan, Armagh. *Enniskillen Coll.*

P. 1467. Four small teeth, approaching *P. sinuosus*. *Egerton Coll.*

P. 1467 b. Two imperfect large teeth. *Egerton Coll.*

P. 2977. Type specimen of *P. constrictus*. This is a fragment of a tooth similar to the last. *Enniskillen Coll.*

Polyrhizodus colei, Davis.

1883. *Polyrhizodus colei*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 502, pl. lx. figs. 9, 10.

1884. *Polyrhizodus colei*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 622, pl. xxvii. fig. 13.

Type. Detached tooth; British Museum.

Crown of tooth relatively high, with much-curved base-line, considerably overhanging the root in front. "Rootlets" only incompletely subdivided.

Form. & Loc. Lower Carboniferous Limestone: Armagh. Upper Carboniferous Limestone (Yoredale Rocks): Yorkshire (*J. W. Davis*).

[1] The tooth figured by Portlock (Geol. Londonderry, pl. xiv. fig. 9) under the name of *Petalodus rectus*, Agass., is considered to be a young example of this species by Morris and Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 102.

P. 2974–5. Type specimens; Armagh. *Enniskillen Coll.*

P. 2976. Ten specimens; some from Tynan. *Enniskillen Coll.*

Polyrhizodus sinuosus, Davis.

1883. *Polyrhizodus sinuosus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 504, pl. lx. figs. 11–13.

Type. Detached teeth; British Museum.

Teeth very similar to those of *P. colei*, but with less elevated crowns, and unsymmetrical.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2970–2. Type specimens. *Enniskillen Coll.*

P. 2973. Four teeth. *Enniskillen Coll.*

Polyrhizodus elongatus, Davis.

1883. *Polyrhizodus elongatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 503, pl. lx. fig. 16.

Type. Detached tooth; British Museum.

Tooth laterally elongated, crown relatively low, with scarcely curved base-line in front and behind. "Rootlets" mostly subdivided.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2966. Type specimen. *Enniskillen Coll.*

P. 2967. Six similar teeth. *Enniskillen Coll.*

Polyrhizodus attenuatus, Davis.

1883. *Polyrhizodus attenuatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 505, pl. lx. fig. 14.

Type. Detached tooth; British Museum.

Teeth scarcely distinguishable from *P. elongatus*, but much smaller. The unworn coronal edge is faintly crenulated. "Rootlets" much subdivided.

Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2968. Type specimen. *Enniskillen Coll.*

P. 2969. Fourteen similar teeth; some from Tynan. *Enniskillen Coll.*

Polyrhizodus concavus (Trautschold).

1874. *Dactylodus concavus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. p. 294, pl. xxviii. fig. 1.

Type. Detached teeth.

Teeth of the typical form of *P. magnus*, but with fewer, often undivided, "rootlets."

Form. & Loc. Carboniferous Limestone: Mjatschkowa, Government of Moscow, Russia.

P. 4487. Two complete, one broken tooth. *Purchased*, 1884.

P. 5111. Three teeth. *Purchased*, 1886.

P. 5490. Five specimens. *Purchased*, 1888.

The Collection also comprises a broken tooth (P. 227 *a*) of uncertain species, from the Carboniferous Limestone of Oreton, Shropshire. *Weaver Jones Coll.*

The following species have also been founded upon detached teeth, but, except of *P. lobatus*, there are no examples in the Collection. To this species is probably referable a broken tooth (**P. 2979**, *Enniskillen Coll.*) from the St. Louis Limestone, Monroe Co., Illinois, U.S.A.

Polyrhizodus amplus, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 387, pl. xiii. fig. 13.—St. Louis Limestone; Illinois, Missouri.

Polyrhizodus carbonarius, St. John & Worthen, *tom. cit.* p. 389, pl. x A. figs. 24, 25, pl. xiii. fig. 10.—Coal-Measures; Illinois.

Polyrhizodus (*Dactylodus*) *concavus*, St. John & Worthen (*non* Trautschold), *tom. cit.* p. 390, pl. xiii. figs. 17, 18.—St. Louis Limestone; Illinois.

Polyrhizodus dentatus, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 50, pl. iii. fig. 10.—Chester Limestone; Illinois.

Polyrhizodus (*Dactylodus*) *excavatus*, St. John & Worthen, *tom. cit.* p. 392, pl. xiii. fig. 16.—Chester Limestone; Illinois.

Polyrhizodus (*Dactylodus*) *inflexus*, Newberry & Worthen, *op. cit.* vol. ii. p. 48, pl. iii. fig. 8.—Chester Limestone; Illinois.

Polyrhizodus littoni, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 357, pl. iv. fig. 10.—St. Louis Limestone; Missouri.

Polyrhizodus (*Dactylodus*) *lobatus*, Newberry & Worthen, *op. cit.* vol. ii. p. 47, pl. iii. fig. 7; *Ctenoptychius digitatus*, J. Leidy,

Trans. Amer. Phil. Soc. [2] vol. xi. (1857), p. 90, pl. v. figs. 27–29.—St. Louis Limestone; Missouri, Illinois.

Polyrhizodus longus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 50, pl. vi. figs. 9, 10.—Carboniferous Limestone; Mjatschkowa, near Moscow.

Polyrhizodus (*Dactylodus*) *minimus*, St. John & Worthen, *tom. cit.* p. 391, pl. xiii. fig. 19.—St. Louis Limestone; Illinois.

Polyrhizodus modestus, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. (1875), p. 50, pl. lviii. fig. 10.—Lower Carboniferous; Ohio.

Polyrhizodus nanus, St. John & Worthen, *tom. cit.* p. 386, pl. xiii. fig. 15.—Keokuk Limestone; Iowa.

Polyrhizodus piasaensis, St. John & Worthen, *tom. cit.* p. 386, pl. xiii. fig. 12.—Warsaw Beds; Illinois.

Polyrhizodus ponticulus, Newberry & Worthen, *op. cit.* vol. ii. p. 51, pl. iii. fig. 11.—Chester Limestone; Illinois.

Polyrhizodus porosus, Newberry & Worthen, *op. cit.* vol. ii. p. 49, pl. iii. fig. 9.—Burlington Limestone; Illinois, Iowa.

Polyrhizodus (*Dactylodus*) *princeps*, Newberry & Worthen, *op. cit.* vol. ii. p. 45, pl. iii. fig. 6.—St. Louis Limestone; Missouri.

Polyrhizodus truncatus, Newberry & Worthen, *op. cit.* vol. iv. p. 357, pl. iii. fig. 16.—Burlington Limestone; Illinois.

Polyrhizodus williamsi, St. John & Worthen, *tom. cit.* p. 384, pl. x. A. fig. 23, pl. xiii. fig. 11.—Keokuk Limestone; Missouri, Iowa.

Genus **GLOSSODUS**, McCoy.

[Ann. & Mag. Nat. Hist. [2] vol. ii. 1848, p. 127.]

Teeth tongue-shaped. Crown very thick, and coronal margin obtuse and rounded. Root long, as wide as the crown, terminating below in two points.

Glossodus lingua-bovis, McCoy.

1848. *Glossodus lingua-bovis*, F. McCoy, Ann. & Mag. Nat. Hist. [2] vol. ii. p. 127.

1848. *Glossodus marginatus*, F. McCoy, *tom. cit.* p. 128.

1855. *Glossodus marginatus*, F. McCoy, Brit. Palæoz. Foss. p. 629, pl. 3 K. fig. 1.

1883. *Glossodus marginatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 510, pl. lxi. figs. 3–5.

Type. Detached tooth; (?) British Museum[1].
Single known species.
Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2648–9. Specimens described and figured by J. W. Davis, *loc. cit.* *Enniskillen Coll.*

P. 2647, P. 2650. Four similar teeth. *Enniskillen Coll.*

P. 2647 a. Naturally associated series of three teeth, showing the typical Petalodont arrangement. This specimen forms the basis of the description and figure by J. W. Davis, *loc. cit.* p. 511, pl. lxi. fig. 4. *Enniskillen Coll.*

P. 1475. Imperfect tooth. *Egerton Coll.*

Genus **MESOLOPHODUS,** nov.

Teeth robust. Crown relatively thick, elevated, with a sharp cutting-edge: posterior face of triangular outline, with truncated summit, slightly hollowed mesially, and with straight inferior margin: anterior face of nearly similar form and size, but with a sharp vertical median ridge and W-shaped base-line. Base of crown with at least one large fold. Root as deep as the crown, abruptly truncate.

The supposed distinct genus represented by these teeth may perhaps pertain to the Petalodontidæ. In some respects the teeth are suggestive of those named *Lisgodus* and *Calopodus*.

Mesolophodus problematicus, sp. nov.

Type. Detached teeth shown, nat. size, in Pl. I. figs. 18, 19.
Single known species.
Form. & Loc. Lower Carboniferous Limestone: Armagh.

P. 2641. Type specimens. The original of Pl. I. fig. 18 is a nearly complete crown displaying the anterior aspect. The tooth shown in Pl. I. fig. 19 is nearly complete and exhibits the characters of the posterior aspect. *Enniskillen Coll.*

P. 2641 a. Three abraded crowns. *Enniskillen Coll.*

The so-called genus *Cymatodus*, H. Trautschold, 1879 (*non* Newberry and Worthen, 1870), may also probably be referred to the

[1] An unmarked tooth in Admiral Jones's Collection, either in the Museum or in the possession of the Geological Society.

Petalodontidæ. The two described species are from the Lower Carboniferous of Russia, and named *Cymatodus plicatulus*, Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 53, pl. vii. fig. 3, and *C. reclinatus*, Bull. Soc. Imp. Nat. Moscou, 1883, pt. ii. p. 169, pl. v. figs. 3, 4. The tooth is very much compressed, and the coronal margin wavy.

Family PRISTODONTIDÆ.

An indefinable extinct family, known only by detached teeth, of a type very similar to some of those referred to the Petalodontidæ. Each tooth is bilaterally symmetrical, and the coronal contour of one is hollowed in such a manner as to precisely "fit" the crown of the other tooth directly opposed to it. These characters are suggestive (though not conclusive proof) of there having been but a single tooth in each jaw of the original fish.

Genus **PRISTODUS,** Davis (*ex* Agassiz, MS.).

[Trans. Roy. Dublin Soc. ser. 2, vol. i. 1883, p. 519.]

Syn. *Diodontopsodus*, J. W. Davis, Brit. Assoc. Rep. 1881, p. 646.

Crown of tooth comparatively thin and plate-like, vertical in front, but sharply bent backwards at a short distance below the apex, thus forming a posterior horizontal portion. The latter portion is flat, with an excavated hinder border, and the vertical portion rises abruptly from its semicircular front margin, with a sharp cutting-edge, highest in the middle and gradually becoming less elevated on each side. Root short and thick, deepest in front, fixed to the horizontal portion of the crown, immediately behind the anterior margin (Pl. I. fig. 13).

In the tooth of one jaw the crown is much thickened at its flexure, and thus, though appearing sharply bent from the anterior aspect, slopes in a gradually curved plane on the posterior face (Pl. I. fig. 13). The directly opposing tooth "bites" outside this one, and accordingly there is a well-marked groove upon its posterior face at the boundary of the sharply separated vertical and horizontal moieties of the crown, the groove becoming gradually deeper to a pit in front which receives the opposing apex. There is no evidence as to the precise relations of these two forms of teeth, but, for convenience of reference, the first may be termed lower, the second upper.

As already recognized by William Davies, R. Etheridge, jun., and

Traquair, the resemblance of the dentition of *Pristodus* to that of the Plectognath *Diodon* is merely one of analogy, and does not imply the least affinity.

Pristodus falcatus, Davis.

1862. *Pristodus falcatus* (Agassiz, MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Pristodus falcatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 519, pl. lxi. figs. 17–22.

1884. *Pristodus falcatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 623, pl. xxvi. figs. 19, 20.

1888. *Pristodus falcatus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 101.

Type. Detached teeth; British Museum.

Coronal margin of upper tooth divided into a series of 10–18 large, acutely-pointed denticulations, diminishing in size from the centre laterally: the centre of the margin is the line of division between the two largest denticulations, there being no median azygous apex. Coronal margin of the lower tooth smooth, with a series of minute pittings beneath, giving it the appearance of being finely denticulated, gradually rising from either side to a median acuminate, but not produced, apex.

Form. & Loc. Upper Carboniferous Limestone: Yorkshire.

36888 a, 49640–42. Four upper teeth; Richmond.
Purchased, 1862, 1878.

P. 1442. Nine portions of similar teeth; Richmond. *Egerton Coll.*

P. 3015. Eighteen portions of similar teeth, some small: Richmond. *Enniskillen Coll.*

P. 4896–7. Five similar teeth; Wensleydale. *Horne Coll.*

P. 3012–4. Two imperfect upper teeth, and impression of the posterior aspect of one lower, figured in Trans. Roy. Dublin Soc. [2] vol. i. pl. lxi. figs. 20–22; Richmond. The original of fig. 21 is wrongly described as a lower tooth; and fig. 20 does not represent the "under surface" of such a tooth, as stated in the text. *Enniskillen Coll.*

P. 3016. Five upper and lower teeth; Yoredale. *Enniskillen Coll.*

P. 1419. Four lower teeth: Richmond. *Egerton Coll.*

P. 3015 a. Twelve lower teeth; Richmond. *Enniskillen Coll.*

P. 4895. Two lower teeth; Wensleydale. *Horne Coll.*

Pristodus concinnus (Davis).

1883. *Pristicladodus concinnus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 385, pl. xlix. fig. 23.

1884. *Pristicladodus concinnus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 621, pl. xxvi. fig. 15.

1888. *Pristodus concinnus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 102.

Type. Imperfect tooth: Horne Collection, York Museum.

Upper tooth probably similar to that of *P. falcatus*; lower tooth differing from the latter species in having the coronal apex produced into a narrow, sharply-pointed prominence.

Form. & Loc. Upper Carboniferous Limestone; Yorkshire.

49637–9. Three crushed lower teeth; Richmond.

Purchased, 1878.

Pristodus benniei (R. Etheridge, jun.)

1875. *Petalorhynchus* (?) *benniei*, R. Etheridge, jun., Geol. Mag. [2] vol. ii. p. 243, pl. viii. figs. 3, 4.

1888. *Pristodus benniei*, R. H. Traquair, *ibid.* [3] vol. v. p. 101.

Type. Upper tooth: Coll. James Bennie.

Coronal margin of upper tooth not dentated, but acuminate and smooth, with delicate punctations, like the margin of the lower tooth: a prominent fold, with traces of others, is seen anteriorly at the base of the vertical portion of the crown. Lower tooth as in *P. falcatus*.

All the known teeth of this species are small compared with those of the Yorkshire species; and if the non-dentated character of the margin of the upper tooth be eventually regarded as of generic value, Etheridge's suggested name of *Hoplodus* may be adopted.

Form. & Loc. Upper Carboniferous Limestone: Scotland: Derbyshire, England.

46046. Crown of upper tooth, referred to by Etheridge, *loc. cit.*; Beith, Ayrshire. *Presented by Robert Craig, Esq.*, 1874.

P. 5344. Five imperfect upper teeth; Ticknall, near Melbourne, South Derbyshire. *Wilson Coll.*

P. 5344 a. Lower tooth, shown of nat. size in Pl. I. fig. 13: Ticknall. *Wilson Coll.*

P. 5344 b. Four imperfect lower teeth; Ticknall. *Wilson Coll.*

P. 3015 b. Upper tooth doubtfully assigned to this species; Richmond, Yorkshire. This specimen appears to differ from the typical teeth only in size. *Enniskillen Coll.*

Family SQUATINIDÆ.

Body depressed, flattened. Mouth anterior. Pectoral fins large, with the basal portion much produced forwards, but not connected with the head. Gill-openings wide, lateral, partly covered by the base of the pectoral. Spiracles wide, behind the eyes. Teeth conical and pointed. Dorsal fins, without spines, upon the tail. Skin more or less provided with small tubercles.

Genus **SQUATINA** (Aldrovandi), Duméril.

[Zool. Analyt. 1806, p. 102.]

Syn. *Squatina*, Aldrovandi, De Piscibus Libri, 1638, p. 471.
Rhina, J. T. Klein, Hist. Pisc. Nat. pt. iii. 1742, p. 13.
Thaumas, Münster, Beitr. Petrefakt. v. 1842, p. 62.
? *Phoreynis*, V. Thiollière, Poiss. Foss. Bugey, 1854, p. 9.
Scaldia, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. 1871, p. 7.
Trigonodus, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. 1876, p. 14.

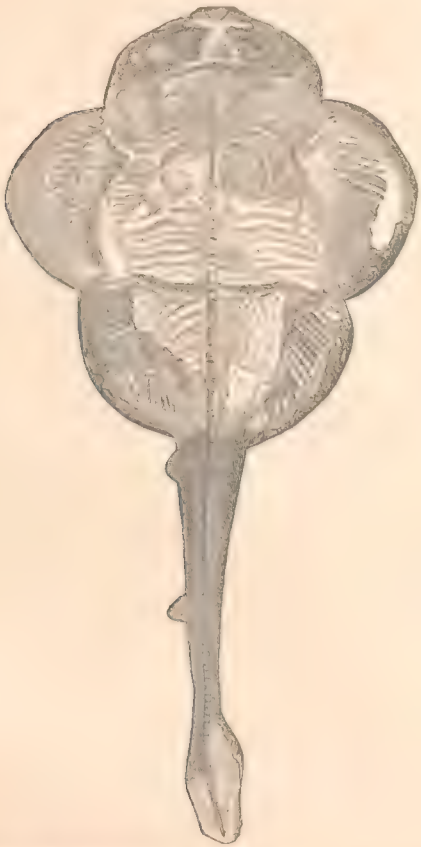
All the fossil Squatinidæ hitherto discovered may be referred to this, the single surviving genus. The teeth are destitute of distinct lateral denticles, and are characterized by a small median downward extension of the crown upon the front of the root beneath the large cone. Three or four rows of the teeth are simultaneously in function, and they are arranged in widely-separated transverse series. There is a median symphysial row in the upper jaw.

Squatina alifera (Münster).

1842. *Thaumas alifer*, Münster, Beitr. Petrefakt. v. p. 62, pl. vii. fig. 1.
1843. *Thaumas fimbriatus*, Münster, *op. cit.* vi. p. 53, pl. i. fig. 4.
1847. *Squatina alifer*, C. Giebel, Fauna d. Vorw. vol. i. pt. iii. p. 298.
1854. *Squatina acanthoderma*, O. Fraas, Zeitschr. deutsch. geol. Ges. vol. vi. p. 782, pls. xxvii.–xxix.
1857. *Thaumas* (*Squatina*) *alifer*, A. Wagner, Gelehr. Anz. bay. Akad. Wiss. vol. xliv. p. 292.
1859. *Squatina alifera*, H. von Meyer, Palæontogr. vol. vii. p. 3.
1861. *Squatina alifera* and *S. acanthoderma*, A. Wagner, Abh. k. bay. Akad. Wiss. math.-phys. Cl. vol. ix. pp. 305, 306.
1876. *Squatina acanthoderma* and *S. alifer*, C. Hasse, Morphol. Jahrb vol. ii. p. 466, pl. xxx. figs. 1, 2, 11, pl. xxxi. figs. 16-18.

1882. *Thaumas alifer*, C. Hasse, Das natürl. Syst. Elasm., Besond. Theil, p. 132, pl. xvii. figs. 10, 12, 16.
1882. *Squatina acanthoderma*, C. Hasse, *op. cit.* p. 130, pl. xvii. figs. 11, 17.
1887. *Squatina alifera*, K. A. Zittel, Handb. Palæont. vol. iii. p. 92, fig. 105.

Fig. 1.



Squatina alifera (Münster).—Lithographic Stone, Eichstätt, Bavaria. (After Zittel.) (One-tenth nat. size.)

Type. Skeleton, with imperfect head and displaced pectoral arch; Munich Museum.

Head gently rounded and blunt in front. Dermal granules varying from simple or stellate hooklets to blunt, rounded tubercles; no great mass of the latter observed in advance of the head or the paired fins. Caudal fin very large.

Fraas published a very complete description of the fish, to which he gave the name of *S. acanthoderma*, making known the skeleton almost in its entirety. We follow von Meyer and Zittel in identifying this form with the species previously described by Münster.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Bavaria.

49149. Plaster cast of type specimen. *Purchased*, 1878.

38002. Plaster cast of type specimen of *Squatina acanthoderma*, Fraas, figured *loc. cit.* pl. xxvii. *Purchased*, 1864.

38151. Plaster cast of nearly complete disk, with caudal vertebræ, from Eichstätt; original in Haarlem Museum. *Purchased*, 1864.

Squatina speciosa, H. von Meyer.

1856. *Thaumas speciosus*, H. v. Meyer, Neues Jahrb. p. 418.
1859. *Squatina* (*Thaumas*) *speciosa*, H. v. Meyer, Palæontogr. vol. vii. p. 4, pl. i. fig. 2.
1861. *Squatina speciosa*, A. Wagner, Abh. k. bay. Akad. Wiss. math.-phys. Cl., vol. ix. p. 307.

Type. Complete skeleton, wanting median fins.

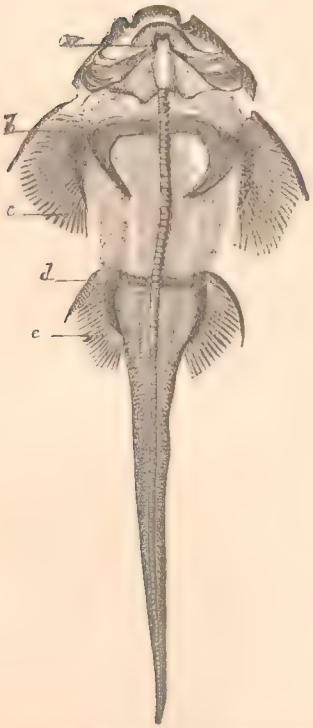
A much smaller species than *S. alifera*, with more slender body, and comparatively acute anterior termination of the cephalic region. Dermal hooklets, upon star-shaped bases, arranged upon the middle of the head, trunk, and tail, and on the basal portions of the paired fins. Series of strong rounded dermal tubercles upon the anterior border of the head and each of the paired fins, and upon the lateral aspect of the tail.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Bavaria.

37997. Plaster cast of type specimen. *Purchased*, 1864.

37013. Specimen almost identical with the type, shown two thirds nat. size in the accompanying woodcut (fig. 2); Solenhofen. *Häberlein Coll.*

Fig. 2.



Squatina speciosa, H. von Meyer.—Lithographic Stone, Solenhofen (No. 37013). (Two-thirds nat. size.)
a, mandible; *b*, pectoral arch; *c*, pectoral fin; *d*, pelvic arch; *e*, pelvic fin.

Squatina baumbergensis, W. von der Marck.

1885. *Squatina baumbergensis*, W. v. d. Marck, Palæontogr. vol. xxxi. p. 264, pl. xxv. figs. 1–5.

Type. Head and trunk, with incomplete paired fins.

This species agrees in size with *Squatina alifera*, but is distinguished by the more elongate form of the pectoral fins, and possibly by the more posterior situation of the pelvic girdle. W. von der Marck describes the latter as being placed over the forty-second vertebra, whereas in *S. acanthoderma*, Fraas, it is over the thirty-second; but circumstances of preservation may perhaps account for a portion of the difference. The shagreen-granules are merely conical, without recurved spines.

Form. & Loc. Upper Cretaceous (Senonian): Baumberg, Westphalia.

Squatina crassidens, sp. nov.

Type. A nearly complete fish, figured (one half nat. size) in Plate II. fig. 1.

Head and branchial region short; the pectoral propterygium extending almost or quite as far forwards as the first branchial arch. The pectoral fins much elongated, with very long metapterygium. Pelvic fins also elongate, with at least twenty basal cartilaginous rays. Skin covered with numerous very minute prickles, but apparently without larger spinous tubercles; series of strong rounded dermal tubercles upon the anterior border of the head and each of the paired fins, and upon the lateral aspect of the tail. Teeth with very low crowns.

Form. & Loc. Upper Cretaceous (Turonian): Sahel Alma, Mount Lebanon, Syria.

P. 4017. Type specimen, figured in Plate II. figs. 1, 4. Except the median fins, almost the whole of the fish is preserved, though in most parts much defaced by crushing and extrication from the matrix. The total length of the fossil is 0·42 metre, and the maximum breadth between the outer margins of the pectoral fins would probably be about 0·25 metre. The vertebræ are of the usual type, and strong ribs occur posterior to the pelvic girdle. In the right pectoral fin the propterygium (*pr.p*) and mesopterygium (*ms.p*) are seen; and there are indications of a preaxial thickened ray in the pelvic fins. The teeth are well shown in a portion of the mouth, and are remarkable for the extreme lowness of the crown. An anterior view of one of these teeth, enlarged seven times, and an upper view, on the same scale, are given in fig. 4: there are radiating striations upon the posterior portion of the crown. The dermal tubercles are very minute, and are better shown in No. 48105 (fig. 5). There are also fossilized remains of the muscles, and a portion of those of the caudal region (*mu*) is so displaced as to have the false appearance of being a fin. *Purchased*, 1883.

49518. Middle portion of fish, shown five ninths nat. size in Plate II. fig. 2. The metapterygium of the pectoral fin is well displayed, with its cartilaginous rays; and there is a distinctly thickened preaxial cartilaginous ray in the pelvic fin. Very singular is the fossilization of the muscles, not

only the septa between the successive myotomes being distinguishable, but also the fine fibres of the muscular substance itself. *Purchased*, 1878.

48105. Fragment of large individual, displaying a portion of the vertebral column and ribs, with parts of the fins and fossilized muscles. The minute dermal tubercles are also well seen upon parts of the specimen, and are represented (enlarged about 15 times) in Plate II. fig. 5; they have an irregular stellate form, with a shallow depression in the central portion. *Purchased*, 1877.

49546. Portion of large individual, viewed from below, showing broken vertebræ with ribs, part of the branchial cartilages, a fragment of the pectoral arch, the right pectoral fin, dermal tubercles, and fossilized muscle. The branchial apparatus is not well preserved, but, so far as can be seen, it appears to present striking differences from that of the living *Squatina*, as figured by Gegenbaur[1]; the basi-branchial cartilage more closely resembles that of *Raja*. *Purchased*, 1878.

49547. Fragmentary specimen, displaying the basal pterygia of the pectoral fins (Pl. II. fig. 3). A wide space appears between these basal cartilages, but is not improbably due in part to shrinkage. At least fifteen cartilaginous rays are articulated with the metapterygium, and eight with the mesopterygium. *Purchased*, 1878.

Squatina cranei, A. S. Woodw.

1888. *Squatina cranei*, A. S. Woodward, Quart. Journ. Geol. Soc. vol. xliv. p. 144, pl. vii. figs. 1–6.

?1850. Teeth of a Squaloid Fish, F. Dixon, Foss. Suss. p. xii, pl. xxx. fig. 35.

Type. Portions of skull, teeth, and dermal tubercles; Willett Collection, Brighton Museum.

An imperfectly known species, remarkable for the great size of the dermal tubercles with recurved spines, probably situated upon the paired fins. The upper anterior teeth are very small, and the opposing teeth of the lower jaw comparatively narrow and slender.

Form. & Loc. Lower Chalk: Sussex.

[1] Kopfskelet der Selachier, 1872, pl. xix. fig. 1.

The following detached teeth of *Squatina* have been obtained from English deposits, but it seems inadvisable to assign them specific names:—

47120. Tooth with high crown, probably from the anterior part of the lower jaw; Gault, Folkestone. *Purchased*, 1876.

25768. Small tooth, with downwardly-directed process of crown very large; Upper Chalk, Brighton. *Dixon Coll.*

R. 5322. Tooth, very similar to the hinder teeth of *S. crami*; Upper Chalk, Lewes. *Presented by James Fox, Esq.*, 1887.

P. 5321. Very robust anterior tooth; Upper Chalk, Norwich.

P. 4104 a. Small tooth; Lower Eocene, Chislehurst, Kent. *Presented by Sydney C. Cockerell, Esq.*, 1883.

43135. Two teeth; London Clay, Highgate Archway. *Wetherell Coll.*

P. 5380. Tooth; Red Crag, Suffolk.

The following vertebræ are also referable to *Squatina*:—

49751. Connected series of four large vertebræ; Chalk, Dorking. *Capron Coll.*

42871. Four examples, labelled by Dr. C. Hasse; Upper Cretaceous, Maastricht, Holland. *Van Breda Coll.*

P. 1307. Two abraded examples, labelled by Dr. C. Hasse; Tufeau de Ciply, Belgium. *Egerton Coll.*

The following detached teeth have been described; but of the species thus imperfectly defined there are no examples in the Collection:—

Squatina alata, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 177, pl. iii. figs. 39, 40.—Molasse; Baltringen, Würtemberg.

Squatina biforis: *Scaldia biforis*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. 1871, p. 7.—Pliocene; Belgium.

Squatina carinata, C. Gichel, Fauna d. Vorw. vol. i. pt. iii. (1847), p. 298.—L. Eocene; Klein Spauwen, Maastricht, Holland.

Squatina caudata, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 178, pl. iii. figs. 41, 42.—Molasse; Baltringen.

Squatina d'ancona, R. Lawley, Nuovi Studi Pesci Colline Toscane, 1876, p. 37, pl. i. fig. 16.—Pliocene; Tuscany.

Squatina fraasi, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 177, pl. iii. figs. 37, 38.—Molasse; Baltringen.

Squatina lobata, A. E. Reuss, Verstein. böhm. Kreideform. pt. ii. (1846), p. 101, pl. xxi. fig. 21; C. Giebel, *op. cit.* vol. i. pt. iii. p. 299.—Plänermergel; Priesen, Bohemia.

? *Squatina moelleri*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1881, pt. ii. p. 14, pl. ii. figs. 1–3, 7–10.—Cretaceous; Russia.

Squatina muelleri, A. E. Reuss, *op. cit.* pt. ii. p. 100, pl. xxi. figs. 18–20; C. Giebel, *op. cit.* vol. i. pt. iii. p. 299.—Plänerkalk; Weisskirchlitz, Borzen, and Kosstitz, Bohemia.

Squatina prima, F. Noetling, Sitzungsb. Ges. naturf. Freunde Berlin, Jahrg. 1886, p. 16; *Trigonodus primus*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. (1876), p. 14, with figs.—L. Eocene (Heersian); Orp-le-Grand, Belgium.

Squatina sp. inc.: "*Cestracion* (?)," E. Delfortrie, Actes Soc. Linn. Bordeaux, vol. xxviii. (1871), p. 215, pl. x. fig. 21.—Pliocene; Salles, Gironde, France.

Detached vertebræ, from the Samland Eocene, have also been named *Squatina beyrichi* by F. Noetling, Abh. geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 45, pl. vii. figs. 2–7.

Others are recorded and described by Hasse from the Plänerkalk of Strehlen, near Dresden[1], and the Upper Chalk of Aix[2], Maastricht[3], and Ciply[4], besides from several European Tertiaries.

Family PRISTIOPHORIDÆ.

Body scarcely depressed; pectoral fins of moderate size, not extending to the snout; gill-openings lateral. Snout produced into a long flat lamina, armed with a series of teeth on each edge; prepalatine cartilages well developed.

This family is as yet unrecognized in the fossil state, except by some detached vertebræ of *Pristiophorus* from the Molasse of Baltringen, Würtemberg, recorded by C. Hasse, 'Das natürl. Syst. Elasm., Besond. Theil,' p. 103, pl. xiii. figs. 6, 7.

[1] Nat. Syst. Elasm., Besond. Theil, p. 134, pl. xviii. fig. 19.

[2] Morphol. Jahrb. vol. ii. p. 466, pl. xxx. fig. 7.

[3] Morphol. Jahrb. vol. ii. p. 466, pl. xxx. fig. 5; Nat. Syst. Elasm., Besond. Theil, p. 134, pl. xviii. figs. 20–26.

[4] Morphol. Jahrb. vol. ii. p. 467, pl. xxx. figs. 3, 10, 12, pl. xxxi. figs. 14, 15; Nat. Syst. Elasm., Besond. Theil, p. 132, pl. xvii. figs. 13–15.

Family PRISTIDÆ.

Body scarcely depressed; pectoral fins of moderate size, not extending to the snout; gill-openings ventral. Snout produced into a long flat lamina, armed with a series of strong teeth on each edge; prepalatine cartilages inconspicuous.

Genus **PRISTIS**, Latham.

[Trans. Linn. Soc. vol. ii. 1794, p. 276.]

Syn. *Myriosteon*, J. E. Gray, Proc. Zool. Soc. 1864, p. 164.

Teeth of rostrum firmly implanted in sockets of calcified cartilage: no tentacles. Teeth in jaws minute, obtuse. Spiracles wide, behind the eyes. Dorsal fins without spine, the first opposite or close to the base of the pelvics; caudal fin large.

The known fossil remains of this genus being only detached vertebræ, teeth, and fragments of the rostrum, it is impossible to determine the number and characters of the extinct species represented in collections. The specific names are thus all provisional.

One of the hollow cartilaginous rods of the rostrum was described by Gray as *Myriosteon*.

Pristis bisulcatus, Agassiz.

1843. *Pristis bisulcatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 382*, pl. 41.

1833 43. *Pristis hastingsiæ*, L. Agassiz, *tom. cit.* p. 382* (name only).

1850. *Pristis*, F. Dixon, Foss. Suss. pl. xii. figs. 6, 7.

1883. *Pristis* (?) *bisulcatus*, W. Dames, Sitzungsb. math.-phys. Cl. Akad. Wiss. Berlin, pt. i. p. 139.

Type. Portion of rostrum, wanting teeth: British Museum.

As already pointed out by Dames, the character to which Agassiz's specific name refers is common to all known Saw-fishes. The original specimen was almost certainly obtained from the same stratum as the majority of the detached rostral teeth resembling that forming the type of *P. hastingsiæ*; and there is every gradation from the small size of the latter to the largest that would be required for the snout indicated by the fossil cartilage. The rostral teeth are grooved posteriorly, and not bent.

Form. & Loc. Upper Eocene: Barton Cliff, Hants. Middle Eocene: Bracklesham Bay, Sussex.

P. 5454. Type specimen, probably from Bracklesham.
History unknown.

P. 1487, P. 3064, 5. Portions of a slightly larger rostrum, 0·145 m. in diameter, with the lateral margins preserved, and three detached teeth; Bracklesham.
Egerton & Enniskillen Colls.

P. 526. Small tooth, named *P. hastingsiæ*, Agassiz, *loc. cit.*: Barton Cliff (not Sheppey, as stated). *Egerton Coll.*

28879. Larger, broader tooth; Barton. *Purchased*, 1854.

25712, 25743. Three fragments; Bracklesham. *Dixon Coll.*

25689. Eleven teeth; Bracklesham. *Dixon Coll.*

40246. Nine small teeth; Bracklesham. *Purchased*, 1867.

38868. Twelve teeth; Bracklesham. *Bowerbank Coll.*

P. 1488. Thirteen teeth and fragments; Bracklesham.
Egerton Coll.

P. 1490. Twelve small teeth; Bracklesham. *Egerton Coll.*

P. 4455. Twelve teeth; Bracklesham. *Enniskillen Coll.*

P. 5382. Four teeth; Bracklesham.
Presented by P. E. Coombe, Esq., 1888.

Pristis contortus, Dixon.

1850. *Pristis contortus*, F. Dixon, Foss. Suss. p. 202, pl. xii. figs. 9, 10.

Type. Rostral tooth; British Museum.
Name given to much bent, robust rostral teeth.
Form. & Loc. Middle Eocene: Bracklesham Bay.

25687. Type specimen. *Dixon Coll.*

25688. Two smaller teeth. *Dixon Coll.*

P. 1489. One similar tooth. *Egerton Coll.*

P. 3066. Five teeth. *Enniskillen Coll.*

P. 5383. Similar tooth. *Presented by P. E. Coombe, Esq.*, 1888.

The Collection also comprises detached rostral teeth of *Pristis* from the Eocene of Alabama (P. 1431), the Calcaire Grossier of Parnes in France (28848), and the Lower Eocene of the neighbourhood of Brussels, Belgium (P. 4456), all purchased.

The following extinct species have also been determined, but are not represented in the Collection. Except when otherwise stated, they are founded upon rostral teeth:—

Pristis acutidens, L. Agassiz, Poiss. Foss. vol. iii. p. 382 ** (name only); Bagshot Sands.

Pristis agassizi, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1847), p. 11, pl. i. figs. 6, 7.—Eocene; South Carolina.

Pristis argustior, J. Probst, Württ. Jahresh. vol. xxxiii. (1877), p. 82, pl. i. figs. 19, 20; C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 125. (Mouth-teeth and vertebræ.) Molasse; Baltringen, Würtemberg.

Pristis aquitanicus, E. Delfortrie, Actes Soc. Linn. Bordeaux, vol. xxviii. (1871), p. 216, pl. x. figs. 30–32. U. Miocene: Léognan, Gironde.

Pristis bassani, A. de Zigno, Mem. R. Istit. Veneto, vol. xxi. (1879), p. 783, pl. xv. figs. 13–15.—Eocene; Italy.

Pristis cuvieidens, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1855, p. 414. Green Sand; New Jersey.

Pristis cuvieiens, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1855, p. 414; Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 252, pl. xxxiv. figs. 31, 32.—Phosphate Beds; S. Carolina.

Pristis lathami, H. Galeotti, Mém. Cour. Acad. Roy. Bruxelles, vol. xii. (1837), no. 3, p. 45, pl. ii. (Portions of snout.) Middle Eocene; Melsbroek, Belgium.

Pristis parisiensis, P. Gervais, Zool. et Pal. franç. pt. v. (Poiss. Foss.), 1852, p. 4, pl. lxviii. figs. 3–7, and *op. cit.* 2nd edit. (1859), p. 519, pl. lxviii. figs. 3–7.—M. Eocene; Soissons and Magny.

Pristis pristinus, J. Probst, Württ. Jahresh. vol. xxxiii. (1877), p. 81, pl. i. figs. 17, 18; C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 125. (Vertebræ.) Molasse; Baltringen.

Rostral teeth from the Miocene of Hérault, France, have been described, without specific name, by P. Gervais, Zool. et Pal. gén. (1867–69), p. 240, woodcut, p. 237, pl. xlvii. fig. 2. Vertebræ from the German Molasse are also made known by C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 125, pl. xvi. figs. 64–67. The supposed vertebra from the Chalk Marl of Saxony (C. Hasse, *op. cit.* p. 124, pl. xvi. figs. 61–63) is probably referable to *Ptychodus*.

Short and broad rostral teeth from the Eocene of Egypt are assigned to a distinct genus and species, *Amblypristis cheops*, Dames, SB. Ges. naturf. Freunde Berlin, June 19, 1888.

Genus **PROPRISTIS,** Dames.

[Sitzungsb. math.-phys. Cl. Akad. Wiss. Berlin, 1883, pt. i. p. 136.]

Fragments of rostrum described as showing that the margin supporting the teeth was not calcified as in the living *Pristis*. The rostral teeth are also said to be distinguished by having no longitudinal groove upon the posterior edge; but the rostral teeth of some living Saw-fishes (e. g. *P. cuspidatus*) are likewise destitute of a posterior groove.

Propristis schweinfurthi, W. Dames, *tom. cit.* p. 136, pl. iii. figs. 1, 2, is the only known species, founded upon portions of the rostrum from the Lower Tertiary of Birket-el-Qurūn, Egypt.

Genus **SCLERORHYNCHUS,** nov.

The portion of snout described below indicates a hitherto unrecognized genus, either of the Pristidæ or Pristiophoridæ. The robust character of the rostral cartilages, and the apparent absence of prominent pre-palatine processes in advance of the nasal capsules, suggest that it may most probably be placed in the first of these families. The teeth of the rostrum are comparatively small and loosely attached to the skin.

Sclerorhynchus atavus, sp. nov.

Type. Imperfect rostrum, shown in Pl. III. fig. 1.

Each rostral tooth comprises a high round base, crimped, and having a somewhat stellate appearance when viewed from beneath; upon this is fixed a backwardly-directed enamelled "crown," compressed to an anterior and posterior sharp edge. These teeth are arranged in single series upon each lateral margin of the snout, increasing considerably in size towards the anterior extremity; miniature tubercles, of the same kind, are also placed upon the upper surface of the base of the snout.

Form. & Loc. Upper Cretaceous (Turonian): Sahel Alma, Mount Lebanon, Syria.

P. 4776. Type specimen. The snout is broken away from the head at the level of the nasal capsules, and only one of these is imperfectly displayed. The outline of the skin is indicated by the marginal series of pointed dermal tubercles, which become considerably enlarged anteriorly, and merit the

name of "rostral teeth": the rostral region is thus seen to taper gradually, forming a long flattened blade. The endoskeletal cartilages are much crushed and broken, and at some distance from the base of the snout, where the tapering decreases, they evidently occupy its entire width, from margin to margin. In addition to the ordinary median prolongation of the cranium itself, there is apparently a laterally-placed pair of large cartilages, corresponding to those of the existing *Pristis*, though it is not possible to determine whether they agree with the latter in structure. *Purchased*, 1884.

Family RHINOBATIDÆ.

Tail strong and long, with two well-developed dorsal fins; a caudal and a longitudinal fold on each side. Disk not excessively dilated, the rayed portion of the pectoral fins not being continued to the snout. No electric organ in the living forms.

Genus **RHINOBATUS**, Bloch (Schneider).

[Schneider, 'Blochii Systema Ichthyologiæ,' 1801, p. 353.]

Syn. *Euryarthra*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 382.
Aellopos, G. von Münster, Neues Jahrb. 1836, p. 581.
Spathobatis, Thiollière, Ann. Soc. Agric. Lyon [2] vol. i. 1849, p. 63.

Body depressed, gradually passing into the tail. Cranial cartilage produced into a long rostral process, the space between the process and pectoral fin being filled by a membrane. Nostrils oblique, wide: anterior nasal valves not confluent. Teeth obtuse, with an indistinct transverse ridge. Dorsal fins without spine, both at a great distance behind the pelvic fins. Caudal fin without lower lobe.

Spathobatis is described by Thiollière as having the disk larger in proportion to the caudal region than in *Rhinobatus*, the pelvic fins being also more approached to the pectorals: but there seems to be an imperceptible gradation between the types, and it is thus convenient, upon present evidence, to recognize but one genus. All the extinct species differ from the recent ones in the approximation of the pelvics to the pectorals, though this may sometimes be a false appearance, due to crushing during fossilization.

The name *Eurygarthra* was proposed by Agassiz for the pectoral fin of a large variety of *Rhinobatus bugesiacus*, in allusion to the great distance between the successive joints in the cartilaginous rays.

Syrrhina[1] is also unrecognizable in a fossil state, and must be included here.

Rhinobatus bugesiacus (Thiollière).

(?) 1836. *Aellopos elongatus*, G. von Münster, Neues Jahrb. p. 581 (incompletely defined).
1843. *Eurygarthra munsterii*, L. Agassiz, Poiss. Foss. vol. iii. p. 382 (incompletely defined).
1849. *Spathobatis bugesiacus*, V. Thiollière, Ann. Soc. Agric. Lyon [2] vol. i. p. 63.
1854. *Spathobatis bugesiacus*, V. Thiollière, Poiss. Foss. Bugey, pt. i. p. 7, pls. i., ii.
1857. *Spathobatis mirabilis*, A. Wagner, Gelehrte Anzeig. bay. Akad. Wiss. vol. xliv. p. 292.
1861. *Spathobatis mirabilis*, A. Wagner, Abh. k. bay. Akad. Wiss. math.-phys. Cl., vol. ix. p. 313.
1887. *Spathobatis mirabilis*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 103, fig. 117 (woodcut).

Type. Complete skeleton.

Snout produced and acute; the two rostral ridges narrow, and separated by a broad groove throughout their length. Cleft of mouth straight. Disk moderately broad; length of pectoral fin nearly 2½ times its breadth at the point of insertion. Skin covered with fine shagreen, without large tubercles or spines.

As shown by Zittel's figure, the so-called *Spathobatis mirabilis* is only a large variety of this species. The Bavarian specimen in the Münich Museum is 1·7 m. in length.

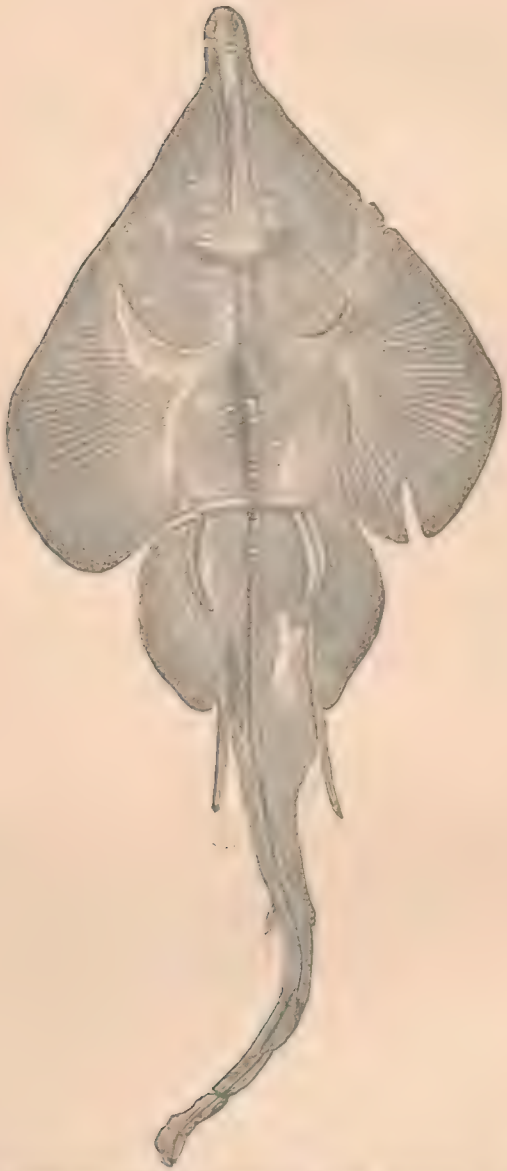
Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Dept. Ain, France; Bavaria.

P. 2099. Impression of a fossil, showing the complete fish, except the extremity of the snout and right pectoral fin; the position of the dorsal fins well seen; Cirin, Ain.
Egerton Coll.

P. 2099 a. Disk, destroyed in advance of the mouth, and including a portion of the caudal region posteriorly; Cirin, Ain.
Egerton Coll.

[1] Müller and Henle, Syst. Beschreib. Plagiostom. 1841, p. 113.

Fig. 3.



Rhinobatus bugesiacus (Thioll.).—Lithographic Stone, Eichstätt. (After Zittel.)
(One-twelfth nat. size.)

Rhinobatus morinicus (Sauvage).

1873. *Spathobatis morinicus*, H. E. Sauvage, Bull. Soc. Académique Boulogne-sur-Mer, p. 94.

Type. Complete skeleton.

Described by Sauvage as differing from *R. bugesiacus* in the less tapering form of the snout, the disk passing more gradually into the tail, and other characters.

Form. & Loc. Lower Portlandian: Mont Lambert, Boulogne-sur-Mer, France.

Rhinobatus maronita, Pictet and Humbert.

1866. *Rhinobatus maronita*, F. J. Pictet & A. Humbert, Nouv. Rech. Poiss. Foss. M. Liban, p. 113, pl. xix.

1887. *Rhinobatus grandis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 482, pl. xvi. fig. 1.

Type. Middle portion of skeleton, with paired fins; Geneva Museum.

Snout acute, but slightly produced: the distance from the extremity to the nasal capsules being not quite equal to the breadth at the latter position. Cleft of mouth straight. Disk much elongated; pectoral fin gently rounded, its length equalling at least three times the breadth at its point of insertion; pelvic fin large and elongate. Body covered with fine, dense shagreen, apparently without larger tubercles.

Form. & Loc. U. Cretaceous (Turonian): Hakel, Mt. Lebanon, Syria.

39233. Anterior portion of disk, wanting extremity. *Tristram Coll.*

39234. Middle portion of trunk, with right pectoral and both pelvic fins. *Tristram Coll.*

47319. Portion of cranial cartilage. *Presented by Sir Richard Owen, K.C.B.*, 1874.

49554. Disk, incomplete in advance of the mouth, and wanting one of the pelvic fins. The remaining pelvic fin is well-preserved, and is shown, of the natural size, in Pl. III. fig. 4. There are twelve pairs of ribs in advance of the pelvic girdle, and four or five behind. *Purchased*, 1878.

49511. Portion of disk, showing pectoral fin and obscure traces of branchial arches and cranium. There are indications of a slender anteriorly-directed process from the outer angle of

the nasal capsule, which may probably be interpreted as pre-palatine. This is shown in Pl. III. fig. 3, *pr.pa.*; and the antorbital or post-palatine (*pt.pa.*) is also seen, of much larger size. *Purchased*, 1878.

49512. Left side of disk, ventral aspect, shown, of two thirds nat. size, in Pl. III. fig. 2. The specimen is slightly distorted, and the extremity of the snout is broken away, though the form of this is distinctly traceable by the stain in the matrix. The first dorsal fin is seen, of the ordinary proportions, in the usual situation, at a considerable distance behind the pelvic fins. *Purchased*, 1878.

49513. Imperfect large example, pectoral fin measuring 0·15 m. in length. *Purchased*, 1878.

P. 4013, P. 4012. Two imperfect large examples, the pectoral fins measuring 0·24 m. in length. The former is described as *R. grandis* by J. W. Davis, *loc. cit.* p. 484: but neither of the specimens appears to exhibit specific differences from *R. maronita*, and the snout of the type specimen of *R. grandis* as figured, *loc. cit.*, is evidently erroneously restored. *Purchased*, 1883.

49510. Half of disk, doubtfully referable to a variety of *R. maronita*. This fossil is very imperfect, but appears to differ from the typical specimen in its greater breadth and the relatively larger size of the pelvic fins. *Purchased*, 1878.

Rhinobatus tenuirostris, Davis.

1887. *Rhinobatus tenuirostris*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 487, pl. xix. fig. 1.

Type. Nearly complete disk; British Museum.

Snout extremely elongated and slender, its length in advance of the nasal capsule being twice as great as the breadth at the latter position. Rostral ridges separated by a narrow groove. Pectoral fins relatively broad, rapidly widening to the maximum breadth opposite their insertion. Body covered with fine, dense shagreen, apparently without large tubercles.

Form. & Loc. U. Cretaceous (Turonian): Sahel Alma, Mt. Lebanon, Syria.

P. 4770. Type specimen. *Purchased*, 1884.

Rhinobatus intermedius, Davis.

1887. *Rhinobatus intermedius*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 489, pl. xx. fig. 1.

Type. Imperfect disk, wanting snout and portion of tail; British Museum.

Founded upon an imperfect specimen related to *R. tenuirostris*, but apparently differing from this species in the proportions of the vertebræ, which are relatively shorter, and also in the large size of the teeth. This example being a male, however, it is uncertain whether the differences in question may not be merely sexual.

Form. & Loc. U. Cretaceous (Turonian): Sahel Alma, Mt. Lebanon, Syria.

49516. Type specimen. *Purchased*, 1878.

Rhinobatus latus, Davis.

1887. *Rhinobatus latus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 485, pl. xvii.

Type. Disk, wanting snout and portion of tail; British Museum.

Snout probably short. Disk broad, gradually passing into the tail. Pectoral fin rounded, length about 1½ times its breadth at the point of insertion. Skin covered with fine dense shagreen, without large tubercles.

Form. & Loc. U. Cretaceous (Turonian): Sahel Alma, Mt. Lebanon, Syria.

P. 4771, P. 4014. Type specimen and counterpart.
Purchased, 1883–4.

Rhinobatus obtusatus, Costa.

1865. *Rhinobatus obtusatus*, O. G. Costa, Paleont. Prov. Napoli, Append. 1 A, p. 109, pl. c.

1882. *Rhinobatus obtusatus*, F. Bassani, Denkschr. math.-naturw. Cl. kais. Akad. Wiss. Wien, vol. xlv. pt. ii. p. 228.

Type. Nearly complete fish.

Snout very short and obtusely rounded. Cleft of mouth straight. Disk relatively broad. Length of pectoral fin equal to about two and a half times the breadth at its point of insertion. Pelvics apparently small. Skin covered with fine shagreen.

Form. & Loc. Upper Cretaceous: Pietraroja, Naples.

Rhinobatus primævus, Zigno.

1874. *Rhinobatus primævus*, A. de Zigno, 'Cat. rag. Pesci Foss. Calc. Eocen. M. Bolca e Postale,' p. 176.

1878. *Rhinobatus primævus*, A. de Zigno, Mem. real. Istit. Veneto Sci. vol. xx. p. 450, pl. xvi.

Type. Complete skeleton, except hinder portion of tail.

Snout apparently rounded and obtuse. Disk much elongated. Length of pectoral fin about three times its breadth at the insertion.

Form. & Loc. Middle Eocene: Monte Bolca, near Verona.

Rhinobatus martensii, F. Noetling (Abh. geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 31, pl. vii. fig. 1), is founded upon vertebræ from the Eocene of Samland, East Prussia. Other vertebræ have been described by C. Hasse from the Senonian of Aix-la-Chapelle [1], the Uppermost Cretaceous of Maastricht, in Holland [2], and Ciply in Belgium [3], the Bruxellian of Etterbeek [4], and Woluwe St. Lambert [5], near Brussels, and the Molasse of Baltringen, Würtemberg [6].

Vertebræ of *Rhinobatus* also occur in the Kimmeridge Clay of England (**46332** *a*. Three examples from Culham, Oxford. *Cunnington Coll.*).

Genus **TRYGONORHINA,** Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 124.]

Genus differing only from *Rhinobatus* in having the anterior nasal valves confluent, and forming a broad quadrangular flap.

Trygonorhina dezignii, J. J. Heckel, Sitzungsb. math.-nat. Cl. k. Akad. Wiss. Wien, vol. xi. (1854), p. 124.—Middle Eocene; **Monte Postale, N. Italy.**

The following genera appear to show that, in Jurassic times, the Rhinobatidæ and Rajidæ were still less differentiated than at the present day. They do not precisely accord with the definition of either of these families.

Genus **BELEMNOBATIS,** Thiollière.

[Poiss. Foss. Bugey, pt. i. 1854, p. 8.]

Tail very distinct from the disk, which is almost of rhombic shape. Pectoral fins not extending forwards beyond the base of the snout; pelvics not notched. Tail with two smooth spines upon the proximal half, and *apparently* two dorsal fins on the distal half, without caudal fin [7]. Body partially covered with conical dermal tubercles, the larger only superficially calcified. Teeth minute, smooth.

[1] Natürl. Syst. Elasm., Besond. Theil, p. 112, pl. xiv. figs. 17–19.
[2] *Ibid.* pp. 111, 116, 118.
[3] *Ibid.* p. 115, pl. xv. figs. 28–31.
[4] *Ibid.* pp. 112, 116, 118, pl. xiv. figs. 20–26, pl. xv. figs. 32–35, 42–46.
[5] *Ibid.* p. 116, pl. xv. figs. 36–39.
[6] *Ibid.* p. 111.
[7] The known fossils do not clearly elucidate this character.

Belemnobatis sismondæ, Thiollière.

1854. *Belemnobatis sismondæ*, V. Thiollière, Poiss. Foss. Bugey, pt. i. p. 8, pl. iii. fig. 1.

1873. *Belemnobatis sismondæ*, V. Thiollière, *op. cit.* pt. ii. (edit. P. Gervais), p. 12, pl. i. fig. 1.

Type. Complete skeleton.

Snout moderately obtuse; tail shorter than disk. Dermal tubercles largest between the pelvic fins; of considerable size along the median line of the back and on the anterior portion of the disk.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Cirin, Ain, France.

Genus **ASTERODERMUS,** Agassiz.

[Rech. Poiss. Foss. vol. iii. p. 381.]

Disk elongate, gradually passing into the tail. Pectoral fins extending forwards as far as the nasal capsules. Most preaxial ray of pelvic fin apparently of great size. Tail with two smooth dorsal spines; disk and tail covered with numerous stellate dermal calcifications.

This genus is placed by Hasse among the Rajidæ.

Asterodermus platypterus, Agassiz.

1843. *Asterodermus platypterus*, L. Agassiz, Poiss. Foss. vol. iii. p. 381, pl. 44. figs. 2–6.

1859. *Asterodermus platypterus*, H. von Meyer, Palæontogr. vol. vii. p. 9, pl. i. fig. 1.

1861. *Asterodermus platypterus*, A. Wagner, Abh. k. bay. Akad. Wiss. math.-phys. Cl. vol. ix. p. 311.

1882. *Asterodermus platypterus*, C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 166.

Type. Skeleton, wanting cephalic region; Mus. Geological Society of London.

Snout produced and acute. Second dorsal spine somewhat smaller than the first, the former being at one fourth the length of the tail from its extremity, and the latter being another fourth in advance. Dermal tubercles largest upon the region of the head and the pectoral girdle.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Kehlheim, Bavaria.

Family RAJIDÆ.

Disk broad, rhombic, generally with dermal asperities; no barbed caudal spine; tail with a longitudinal fold on each side, median fins varying in development. The pectoral fins extend to the snout. No electric organ in the living forms, except an occasional rudiment in the tail.

Genus **RAJA**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 134.]

Syn. *Actinobatis*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 372.

Tail very distinct from the disk; body rarely destitute of asperities. Pectoral fins not extending forwards to the extremity of the snout: pelvics deeply notched, with robust foremost cartilaginous ray. Two dorsal fins on the tail: caudal fin rudimentary or absent.

Raja expansa (Davis).

1887. *Rhinobatus expansus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 486, pl. xviii.

Type. Disk, without snout, and portion of tail: British Museum.

Snout unknown, probably obtuse. Disk extremely broad, the pectoral fins being almost triangular in shape, and their maximum breadth nearly equal to their length. Outer pectoral angle acute. Skin covered with fine shagreen, apparently without asperities.

The form and proportions of the disk, the forward extension of the pectoral fins, and the slenderness of the tail separate this species from the Rhinobatidæ, and suggest its probable reference to the genus *Raja*.

Form. & Loc. Upper Cretaceous (Turonian): Hakel, Syria.

P. 4772. Type specimen. *Purchased*, 1884.

Raja minor, Davis.

1887. *Raja minor*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 493, pl. xxi. fig. 2.

Type. **Imperfect skeleton; British Museum.**

A small species (or young of larger form?), with rounded pectoral fins, longer than broad. Dermal asperities and shagreen either absent or very minute, except on the tail, where one or more large thorn-shaped spines are situated.

The thickened anterior pelvic fin-ray is wrongly termed a spine in the original description of this fish.

Form. & Loc. Upper Cretaceous (Turonian): Sahel Alma, Mount Lebanon, Syria.

P. 4780. Type specimen. *Purchased*, 1884.

Raja primarmata, sp. nov.

Type. **Specimens figured in Pl. IV. figs. 1–3.**

Snout probably acute. Angle of pectoral fin acute. A series of

large oval conical tubercles, radiately grooved, is arranged along the middle of the back and tail; and two regular series of similar smaller tubercles are placed on either side of the median line.

Form. & Loc. Upper Cretaceous (Turonian): Sahel Alma, Syria.

P. 4015–6, 49517. Type specimens figured in Pl. IV. figs. 1–3. The second is preserved in counterpart.

The first of these fossils consists of the much-crushed middle portion of the disk and anterior extremity of the tail. The caudal region is slender at its commencement, and a portion of one of the pelvic fins is preserved, displaying the thickened preaxial ray. The body is covered with fine shagreen; and larger tubercles, viewed from below or only seen as impressions, have the characters and disposition already noted in the specific description.

The second fossil exhibits the complete anterior half of one of the pectoral fins, extending to the snout, in addition to portions of the skull, branchial arches, vertebral column, and pectoral arch. The pectoral fin is very broad, but rapidly tapers anteriorly. The region in advance of the pectoral arch is elongated, and is suggestive of an acute snout. The teeth are rounded and minute. The hinder portion of the fossil is much crushed, and only a few of the dermal tubercles are shown, scattered and displaced.

Purchased, 1878, 1883.

Raja similis, sp. nov.

Type. Dermal tubercles, figured in Pl. IV. figs. 4, 5.

A number of dermal tubercles from the Upper Eocene of Hampshire are so similar to those of *Raja* that they may be provisionally associated with this genus. They are rounded or oval, and all pointed at one extremity; the inferior surface is convex and smooth; the exposed surface is also slightly convex, and marked with a few delicate concentric and radiating ridges. No spine is preserved in the fossils, but a small one appears to have been affixed to the middle of most of the tubercles.

Form. & Loc. Upper Eocene (Barton Clay): Hampshire.

28094. Eleven specimens, including the types; High Cliff.

Presented by F. E. Edwards, Esq., 1852.

29023. Four specimens; Chutan. *Cowderoy Bequest.*

Raja clavata, Linn.

1767. *Raja clavata*, Linnæus, Syst. Naturæ, vol. i. p. 397.
1843. *Raja antiqua*, L. Agassiz, Poiss. Foss. vol. iii. p. 371, pl. 37. fig. 33.
1876. *Raja antiqua*, R. Lawley, Nuovi Studi Pesci foss. Colline Toscane, p. 42, pl. ii. fig. 1.
1882. *Raja clavata*, E. T. Newton, Vert. Forest Bed (Mem. Geol. Surv.), p. 132, pl. xix. figs. 10, 11.
1886. *Raja antiqua*, O. Larrazet, Bull. Soc. Géol. France (3), vol. xiv. p. 261, pl. xiii. fig. 7.

Type of "*Raja antiqua*." Spinous dermal tubercle.

The fossil dermal tubercles described as *R. antiqua* are indistinguishable from those of the living *R. clavata*, and the Pliocene fossil may thus be provisionally associated with this species. Newton records teeth from the Weybourn Crag of East Runton.

Form. & Loc. Weybourn, Norwich, Red and Coralline Crags: Norfolk, Suffolk. Pliocene: Tuscany.

23200. Nineteen fragmentary tubercles; Norwich Crag, Postwick. *Presented by Dr. S. P. Woodward*, 1849.

P. 374. Nine similar specimens; Norwich Crag, near Norwich. *Bayfield Coll.*

P. 5453. Sixteen tubercles, and nine broken spines of ditto; Norwich Crag, near Norwich. *Wigham Coll.*

P. 267. Abraded tubercle; Coralline Crag, Orford, Suffolk. *Purchased*, 1880.

40402. Tubercle, probably of this species; Coralline Crag, Gedgrave. *Purchased*, 1867.

40403. Abraded tubercle; Red Crag, Felixstow. *Purchased*, 1867.

35863. Two specimens; Red Crag, Suffolk. *Presented by J. Berners, Esq.*, 1861.

41276. Ten specimens; Red Crag, Waldringfield. *Purchased*, 1869.

27615, 30904, 37742, 41853, 43325. Twenty-three specimens, some of very large size, and some consisting of two connected tubercles; Red Crag, Woodbridge. *Purchased.*

P. 3063. Eight similar specimens; Red Crag, Suffolk. *Enniskillen Coll.*

47021. Three tubercles, labelled by Lawley; Pliocene, Orciano, Tuscany. *Purchased*, 1875.

The following species have also been founded upon imperfect evidence, and do not appear to be represented in the Collection. Except where otherwise stated, the type specimens are dermal tubercles.

Raja agassizii, Larrazet, Bull. Soc. Géol. France [3], vol. xiv. (1886), p. 259, pl. xiii. figs. 1–6.—Tertiary; Villa Urquiza, Rio Parana, S. America.

Raja applanata, J. Probst, Württ. Jahresh. vol. 33 (1877), p. 98, pl. ii. figs. 9–11.—Molasse; Baltringen, Würtemberg.

Raja bicornuta, J. Probst, *tom. cit.* p. 79, pl. i. fig. 15 (tooth).—Molasse; Baltringen.

Raja borussica, E. Noetling, Abh. geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 41, pl. ix. figs. 1–5 (vertebra).—Eocene; Samland.

Raja cavernosa, J. Probst, *tom. cit.* p. 75, pl. i. figs. 1–4 (tooth).—Molasse; Baltringen.

Raja conica, J. Probst, *tom. cit.* p. 99, pl. ii. figs. 13–15.—Molasse; Baltringen.

Raja evacuata, J. Probst, *tom. cit.* p. 101.—Molasse; Baltringen.

Raja grandis, J. Probst, *tom. cit.* p. 78, pl. i. fig. 14 (tooth); C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 169.—Molasse; Baltringen.

Raja (?) *helvetica*, C. v. Fischer-Ooster, Mitth. naturf. Gesell. Bern, 1866, p. 267 (with fig.) (egg-capsule).—Molasse; Switzerland.

Raja lobata, J. Probst, *tom. cit.* p. 99, pl. ii. fig. 12.—Molasse; Baltringen.

Raja mammillaris, J. Probst, *tom. cit.* p. 97, pl. ii. figs. 7, 8.—Molasse; Baltringen.

Raja molassica, K. A. von Zittel, Handb. Palæont. vol. iii. (1887), p. 104, woodc. fig. 118: *Acipenser molassicus*, J. Probst, Württ. Jahresh. vol. 38 (1882), p. 121, pl. ii. figs. 1–5, 10–14, 16.—Molasse; Baltringen.

Raja (*Actinobatis*) *ornata*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 372, pl. xxxvii. fig. 34.—Pliocene; Piacenza, Italy.

Raja philippi, Münster, Beitr. Petrefakt. vii. p. 33, pl. ii. fig. 22; J. Probst, Württ. Jahresh. vol. 33, p. 97, pl. ii. fig. 6.—Molasse; Cassel and Baltringen.

Raja pulchra, K. E. Schafhäutl, Süd-Bayerns Leth. Geogn. 1863, p. 249, pl. lxiv. fig. 12.—Eocene; Bavaria.

Raja rhombidens, J. Probst, *tom. cit.* p. 79, pl. i. fig. 16 (tooth).—Molasse; Baltringen.

Raja rugosa, J. Probst, *tom. cit.* p. 76, pl. i. figs. 5–9 (tooth).—Molasse; Baltringen.

Raja spiralis, Münster, Beitr. Petrefakt. vii. p. 33, pl. ii. fig. 24.—Sandstone; Jacobsberg, Minden.

Raja strangulata, J. Probst, *tom. cit.* p. 77, pl. i. figs. 10–13 (tooth).—Molasse; Baltringen.

Raja subasperrhynchus, R. Lawley, Nuovi Studi, etc. 1876, p. 43, pl. ii. figs. 2, 5 (teeth).—Pliocene; Orciano, Volterra (Tuscany).

Undetermined species of *Raja* are recorded by C. Hasse, *op. cit.*, upon the evidence of detached vertebræ from the Upper Chalk of Maastricht (p. 167, pl. xxii. figs. 5–7), the Miocene Molasse of Baltringen (p. 167, pl. xxii. figs. 8, 9), and the Pliocene Crag of Antwerp (p. 170, pl. xxii. figs. 16–20).

Teeth of the existing *Raja batis* have been determined from the Weybourn Crag of East Runton, Norfolk, by E. T. Newton, Vert. Forest-bed Series (Mem. Geol. Surv. 1882), p. 131, pl. xix. fig. 9.

Genus **DYNATOBATIS,** Larrazet.

[Bull. Soc. Géol. France [3], vol. xiv. 1886, p. 258.]

Dermal tubercles with enormous base and very small spine.

Three species are determined by Larrazet, two from the Tertiary of the Rio Parana, South America, the first of unknown formation and locality:—

Dynatobatis gaudryi, Larr. *loc. cit.* p. 265, pl. xv. fig. 2.

Dynatobatis paranensis, Larr. *loc. cit.* p. 263, pl. xiv. figs. 1–4.

Dynatobatis rectangularis, Larr. *loc. cit.* p. 264, pl. xv. fig. 1.

Genus **ACANTHOBATIS,** Larrazet.

[Bull. Soc. Géol. France [3], vol. xiv. 1886, p. 258.]

High dermal tubercles, with small base, several fused together.

The following species are recognized:—

Acanthobatis crimia, Larrazet, *loc. cit.* p. 265, pl. xv. fig. 3, pl. xvi. fig. 1.—Molasse; Gard, France.

Acanthobatis tuberculosus, K. A. von Zittel, Sitzungsb. math.-phys. Cl. k. bay. Akad. Wiss. vol. xvi. 1886, p. 264; Handb. Palæont. vol. iii. 1887, p. 105, fig. 121: *Acipenser tuberculosus*, J. Probst, Württ. Jahresh. vol. 38 (1882), p. 127, pl. ii. figs. 6–9, 15.—Molasse; Baltringen, Würtemberg.

Genus **ONCOBATIS,** Leidy.

[Proc. Acad. Nat. Sci. Philad. 1870, p. 70.]

Dermal tubercles of pentagonal outline, with the under surface convex and smooth; upper surface presenting five sloping planes, more or less well defined by prominent borders, the raised central portion covered with gano-dentine. [? *Raja.*]

Oncobatis pentagonus, J. Leidy, *loc. cit.*, and Extinct Vert. Fauna West. Territ. (Rep. U. S. Geol. Surv. Territ. vol. i. pt. i. 1873), p. 264, pl. xvii. figs. 18, 19.—Pliocene: Sinker Creek, Idaho.

Family TORPEDINIDÆ.

Disk broad, smooth: skeleton of pectoral fins not continued forwards beyond the base of the snout. Median fins well developed. An electric organ between the pectoral fins and the head.

Genus **TORPEDO,** Duméril.

[Zool. Analyt. 1806, p. 102.]

Syn. *Narcobatis*, de Blainville, Faune Française—Poissons, 1820–30, p. 43.

Tail moderately developed, with two dorsal fins; pelvic fins separate; spiracles at a short distance behind the eyes.

Torpedo egertoni, A. de Zigno, Mem. R. Istit. Veneto, vol. xx. (1878), p. 152, pl. xvii.—Middle Eocene; Monte Bolca, near Verona.

Torpedo gigantea, L. Agassiz, Neues Jahrb. 1835, p. 297, and Poiss. Foss. vol. iii. p. 382**: *Raja torpedo* (Linn.), Volta, Ittiolit. Veron. 1796, p. 251, pl. 61: *Narkobatus giganteus*, de Blainville, Nouv. Dict. d'Hist. Nat. vol. xxvii. 1818, p. 337.—Middle Eocene; Monte Bolca.

Torpedo, sp., C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 176, pl. xxiii. figs. 15–18.

Detached vertebræ, supposed to belong to *Astrape*, have been recorded from the amber-bearing beds of Samland, East Prussia (F. Noetling, Abh. geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3, Lief. i. p. 36, pl. viii. figs. 6–9). They are named *Astrape* (?) *media*, and were originally referred to *Torpedo* by C. Hasse, Palæontogr. vol. xxxi. (1884), p. 5, pl. i. figs. 6, 7.

Vertebræ of *Narcine* are also recorded by Hasse from the Tufeau de Ciply (Natürl. Syst. p. 178, pl. xxiii. figs. 22, 23) and the Bruxellian of Woluwe St. Lambert (*op. cit.* p. 178, pl. xxiii. figs. 24, 25).

Family PSAMMODONTIDÆ.

An extinct family, imperfectly recognizable, being known only by remains of the dentition. As shown by the teeth, the two rami of the jaws were evidently placed in the same straight line—a fact probably indicating a much-depressed body, like that of the existing Rays. The teeth are flattened, more or less quadrate, and have the root the same size as the crown; the contour of the base of the root corresponds to that of the crown, and the attached surface exhibits only slight longitudinal striations. The dentition was originally arranged in one, two, or several longitudinal series, arched antero-posteriorly; and when there are two or more series, the corresponding rows of the opposite sides are symmetrical. The teeth of adjoining series are not exactly opposite each other, but slightly alternating.

Genus **COPODUS,** Davis (*ex* Agassiz MS.).

[J. W. Davis, Trans. Roy. Dubl. Soc. [2] vol. i. 1883, p. 464.]

Syn. *Labodus*, Agassiz MS., Davis, *loc. cit.* p. 468.
Mesogomphus, Agassiz MS., Davis, *loc. cit.* p. 470.
Rhymodus, Agassiz MS., Davis, *loc. cit.* p. 473.
Characodus, Agassiz MS., Davis, *loc. cit.* p. 474.
Pinacodus, Agassiz MS., Davis, *loc. cit.* p. 476.

Teeth bilaterally symmetrical, with the postero-lateral angles of the root, and sometimes also of the crown, much produced backwards. They are narrower in front than behind, and the anterior margin is generally straight or convex. Coronal surface slightly rugose when unabraded, and generally almost flat, though in some cases upturned laterally; root about twice as thick as the crown. The teeth are especially characterized by the presence in each of a transverse sutural line, dividing a smaller or larger portion from the remainder, sometimes allowing of the complete separation of the parts, sometimes only faintly marked.

The dentition of each jaw probably consisted only of a single antero-posterior series of teeth.

The following is a provisional arrangement of the species, the number of which will doubtless be considerably reduced when more perfect specimens are known.

Copodus cornutus, Davis (*ex* Agassiz MS.).

1843. *Psammodus cornutus*, Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).

(?) 1843. *Psammodus cornutus*, J. E. Portlock, Rep. Geol. Londonderry, p. 461, pl. xiv. *a*, fig. 3.

(?) 1855. *Psammodus cornutus*, F. M'Coy, Brit. Palæoz. Foss. p. 643.

1862. *Copodus cornutus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).

1862. *Copodus lunulatus* (Agassiz MS.), Morris & Roberts, *loc. cit.* p. 100 (name only).

1883. *Copodus cornutus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 464, pl. lviii. figs. 2–5 (*non* fig. 1).

(?) 1883. *Pinacodus gonoplax* (Agassiz MS.), J. W. Davis, *loc. cit.* p. 477, pl. lviii. fig. 22.

Type. Detached teeth; British Museum.

Teeth mostly longer than broad; a curved transverse suture dividing the posterior fourth (or more) of the tooth from the anterior portion. The posterior border of the latter is excavated and gently curved, and the postero-lateral angles are not greatly produced. The small isolated hinder portion of the tooth has a sinuous posterior margin, strongly convex in the middle.

It does not appear certain that the tooth originally figured by Portlock as pertaining to this species is the same as those upon which the foregoing diagnosis is founded. It seems advisable, however, to follow Agassiz's intentions as interpreted by J. W. Davis, who first fully defined the form.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland; Northumberland (*M'Coy*). Upper Carboniferous Limestone: Yorkshire.

Unless otherwise stated, the following specimens are from the Enniskillen Collection.

P. 2580–3. Four type specimens described and figured by J. W. Davis, *loc. cit.*

P. 2584. Thirty-six examples of the main portion of the tooth.

P. 2584 c. Similar specimen, showing a sinuous transverse suture near the anterior extremity.

P. 2584 a. One small specimen, showing posterior portion of tooth in position, half as large as the anterior.

P. 2584 b. Two detached examples of the posterior portion of the tooth.

P. 1406–7. Six examples of the anterior portion of the tooth. *Egerton Coll.*

26053–4, 38506. Eight similar specimens. *Purchased*, 1851, 1864.

P. 2507. Type specimen of *Pinacodus gonoplax*, probably referable to the present species. The anterior suture has already been noted in P. 2584 c.

49617. Small tooth, probably of this species; Richmond, Yorkshire. *Purchased*, 1878.

Copodus spatulatus, Davis.

1862. *Copodus spatulatus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).
1883. *Copodus spatulatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 467, pl. lviii. fig. 7.
1883. *Copodus cornutus*, J. W. Davis, *tom. cit.* pl. lviii. fig. 1.
1883. *Mylacodus quadratus*, J. W. Davis, *tom. cit.* p. 480, pl. lviii. figs. 27, 28.
(?) 1883. *Mylacodus sesamini*, J. W. Davis, *t. c.* p. 481, pl. lviii. fig. 29.
1884. *Copodus cornutus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 623, pl. xxvii. fig. 22.

Type. Detached tooth; British Museum.

Teeth mostly longer than broad, though sometimes of the reverse proportions; crown comparatively flat; a transverse suture, almost straight and sharply curved backwards at its extremities, dividing a narrow posterior part of the tooth from the larger anterior portion. The postero-lateral angles of the root are extraordinarily produced backwards, but the corresponding extensions of the crown are very slight or absent. The small hinder portion of the tooth has a nearly straight posterior margin, being of equal width throughout.

The specimens in the collection exhibit every gradation between the typical elongate form of tooth and those described under the names of *Mylacodus quadratus* and *M. sesamini*. The original of J. W. Davis's fig. 27, pl. lviii. *loc. cit.*, is merely a broken and abraded crown, and the other specimen shows the base of the postero-lateral "horns" of the root. The coronal surface of the last-named fossil also shows the slight rugosity erroneously described as distinctive in *M. sesamini*. One of the specimens, broader than long, exhibits the narrow posterior portion of the tooth in its natural position; and the form of the hinder margin of the type of *M. sesamini* is largely due to fracture.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland. Upper Carboniferous Limestone: Yorkshire, Derbyshire.

Unless otherwise stated, the following specimens are from Armagh, and in the Enniskillen Collection.

P. 2513. Type specimen, figured *loc. cit.*

P. 2579. A much worn and abraded specimen, figured by J. W. Davis, *l. c.* pl. lviii. fig. 1, as *C. cornutus*.

P. 2514, P. 2585. Eighteen examples, some broken and much abraded, some perfect, and showing more or less of the posterior portion of the tooth.

P. 2496–7. Type specimens of *Mylacodus quadratus*.

P. 2495. Type specimen of *Mylacodus sesamini*.

P. 2498. Thirty-two specimens, relatively short, some much broken and abraded, two showing the posterior portion of the tooth in position.

P. 1408–9. Four imperfect examples. *Egerton Coll.*

P. 2504 a. Perfect tooth with base, wanting hinder portion.

26053 a. Very broad broken specimen, showing hinder portion of tooth in position. *Purchased*, 1851.

P. 5362. Three small teeth; Ticknall, near Melbourne, S. Derbyshire. Two are shown, of the natural size, in Pl. I. figs. 14, 15. *Wilson Coll.*

Copodus furcatus, Davis.

1862. *Copodus falcatus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).

1883. *Copodus furcatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 466, pl. lviii. fig. 16.

Type. Detached tooth; British Museum.

Teeth similar to those of *C. spatulatus*, but having the posterior portion separated by a suture strongly bent in the middle, giving to the detached piece a triangular form.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2509. Type specimen. *Enniskillen Coll.*

Copodus lingua (Davis).

1862. *Mesogomphus lingua* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Mesogomphus lingua*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 471, pl. lviii. fig. 16.

Type. Imperfect detached tooth; British Museum.

Teeth longer than broad; crown flat; the anterior margin

rounded, but often comparatively acute. A median semicircular suture separates a very small posterior portion of each tooth.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2500. Type specimen. *Enniskillen Coll.*

P. 2501. A less perfect example, with the posterior semicircular portion broader, and the anterior margin less curved. *Enniskillen Coll.*

Copodus auriculatus (Davis).

1862. *Pleurogomphus auriculatus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Pleurogomphus auriculatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 472, pl. lviii. fig. 15.

Type. Detached tooth; British Museum.

Teeth similar to those of the latter species, but having two postero-lateral semicircular portions separated by suture, instead of the single median one.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2601. Type specimen. *Enniskillen Coll.*

P. 2585. Less perfect, but larger example. *Enniskillen Coll.*

Copodus minimus, Davis.

1883. *Copodus minimus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 467, pl. lviii. fig. 8.

Type. Detached teeth; British Museum.

Teeth longer than broad: crown flat; a curved, almost angularly bent, transverse suture dividing a small posterior portion of each tooth from the remainder. The posterior border of the entire tooth is very slightly excavated; and the tooth rapidly becomes narrowed anteriorly, the front margin being nearly straight.

Form. & Loc. Upper Carboniferous Limestone: Richmond, Yorkshire.

P. 2511. Type specimen. The suture is shown in this fossil, though not noted in the original description and scarcely in the figure. *Enniskillen Coll.*

P. 2512. Two much abraded teeth, probably referable to this species, but larger. *Enniskillen Coll.*

Copodus planus (Davis).

1862. *Labodus planus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Labodus planus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 470, pl. lviii. figs. 12–14.

Type. Detached teeth; British Museum.

Teeth mostly broader than long, though sometimes of the reverse proportions; crown comparatively flat; the posterior border more or less strongly convex in the middle, and the anterior border straight, with gently rounded lateral angles, and with a slight tendency to median excavation. Anteriorly, the tooth is somewhat narrower than behind; and the postero-lateral angles of the root are much produced backwards. The unabraded coronal surface is slightly rugose, and there is rarely any trace of a transverse suture; when present, this is faintly marked and almost median,

This diagnosis is founded upon the specimens in the collection, but it is not improbable that a small narrow portion of tooth was originally connected with the posterior margin of the examples thus described.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2590–2. Type specimens. *Enniskillen Coll.*

P. 2593. Twenty-four examples, some much broken and abraded. *Enniskillen Coll.*

49618. Small imperfect tooth, doubtfully associated with this species; Upper Carboniferous Limestone, Richmond, Yorkshire. There is a suture, as shown in No. P. 2592 (Davis, pl. lviii. fig. 14), but the tooth is relatively broader and more arched antero-posteriorly. *Purchased*, 1878.

49620. A smaller tooth, without suture; Richmond. *Purchased*, 1878.

Copodus oblongus (Davis).

1862. *Mylax batoides* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Rhynodus oblongus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 473, pl. lviii. fig. 18.

1883. *Mylax batoides*, J. W. Davis, *tom. cit.* p. 479, pl. lviii. figs. 25, 26.

Type. Detached tooth; British Museum.

Teeth much broader than long; crown comparatively flat, the coronal surface only slightly raised in the middle; a posterior portion

separated by a straight or slightly curved transverse suture, about half as large as the anterior portion. The anterior margin of the tooth strongly convex, and the posterior margin slightly so; the root extending far beyond the crown on either side, and produced backwards at the postero-lateral angles.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2595–6. Type specimen and broken tooth. *Enniskillen Coll.*

P. 2493–4. Type specimens of *Mylax batoides*, both fragmentary. *Enniskillen Coll.*

P. 5325. Two more perfect examples. *Enniskillen Coll.*

Copodus prototypus (Davis).

1862. *Labodus prototypus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Labodus prototypus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 468, pl. lviii. figs. 9–11.

1883. *Rhynodus transversus*, J. W. Davis, *loc. cit.* p. 473, pl. lviii. fig. 17.

Type. Detached teeth; British Museum.

Teeth much broader than long, and strongly arched antero-posteriorly. The lateral margins of the crown are upturned and the median portion much raised; the root extends considerably beyond on either side, and its postero-lateral angles are somewhat produced backwards. The unabraded coronal surface is very slightly rugose, and there is occasionally one sinuous transverse suture—sometimes two—imperfectly marked.

These are probably the opposing teeth of *Copodus spatulatus*, and perhaps also of *C. linguæ* and *C. auriculatus*; they have, however, not yet been discovered in their natural position, and it is thus convenient to retain provisionally the specific name already proposed for them.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

Unless otherwise stated, the following specimens are from the Enniskillen Collection:—

P. 2586–8. Type specimens.

P. 9258, P. 2594. About forty specimens in various stages of wear and abrasion. Some are deeply worn in the middle, one also at each side. A few show a single transverse suture, one has two sutures.

P. 1405. Ten examples, some abraded and broken. *Egerton Coll.*

P. 2597. Type specimen of *Rhymodus transversus* (Agassiz MS.), Davis. This only differs from *Copodus prototypus* in its great lateral elongation, and is thus probably not separable.

Copodus angulatus (Davis).

1862. *Characodus angulatus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 99 (name only).

1883. *Characodus angulatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 475, pl. lviii. figs. 19, 20.

(?) 1883. *Pinacodus gelasimus*, J. W. Davis, *loc. cit.* p. 477, pl. lviii. fig. 23.

Type. Detached teeth; British Museum.

Teeth very similar to those of *C. prototypus*, but differing in the smaller lateral extension of the root, and in the straighter posterior margin, which is often slightly concave.

This may possibly be the opposing dentition of *C. cornutus*.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

Unless otherwise stated, the following specimens are from the Enniskillen Collection:—

P. 2502–3. Type specimens.

P. 2504. Ten examples, mostly abraded.

P. 5326. A perfect tooth, detached from the matrix.

P. 1410, 11. Three small specimens. *Egerton Coll.*

38506 a. Two specimens. *Purchased*, 1864.

P. 2508. Type specimen of *Pinacodus gelasimus*. This is an extremely abraded tooth, and agrees so closely in outline with *C. angulatus*, that it must be associated with this species until the discovery of further evidence renders its position certain.

Copodus (?) cuneatus (Davis).

1862. *Characodus cuneatus* (Agassiz MS.), Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 99 (name only).

1883. *Characodus cuneatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 475, pl. lviii. fig. 21.

Type. Detached tooth; British Museum.

Teeth narrower in front than behind, and much arched antero-posteriorly. Crown thick or considerably bent downwards laterally,

with the lateral margins strongly crimped; posterior border straight or convex.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2505. Type specimen, in some respects very suggestive of a Cochliodont dental plate. *Enniskillen Coll.*

Dimylus woodi, J. W. Davis (*ex* Agassiz MS.)[1], is founded upon an indeterminable broken tooth (**P. 2602**) from the Upper Carboniferous Limestone of Richmond, Yorkshire, perhaps referable to *Copodus*, perhaps Cochliodont. The published figure is misleading, the remains of the root extending considerably on either side of the fragments of the crown represented; the division between the two portions is evidently an accidental fracture.

The following species of *Copodus* have also been described upon the evidence of detached teeth, but there are no examples in the Collection:—

Copodus convexus: *Rhynodus convexus*, J. W. Davis, Geol. Mag. [3] vol. iii. (1886), p. 155, woodc. fig. 7.—Carboniferous Limestone; Chapel-en-le-Frith, Derbyshire.

Copodus van hornii, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 229, pl. xx. figs. 2, 3.—St. Louis Limestone; Missouri, Illinois.

Copodus pusillus, St. John & Worthen, *tom. cit.* p. 231, pl. xx. fig. 1.—Chester Limestone; Illinois.

Copodus variabilis; *Mylacodus variabilis*, J. W. Davis, Geol. Mag. [3] vol. iii. (1886), p. 154, woodc. figs. 5, 6.—Carboniferous Limestone: Chapel-en-le Frith, Derbyshire. [? *Psammodus*.]

If specifically distinct, and rightly to be placed here, *Characodus minimus*, Davis (Geol. Mag. [3] vol. iii. p. 155, woodc. fig. 8), will require a new specific name.—Carboniferous Limestone; Chapel-en-le-Frith.

Genus **PSAMMODUS**, Agassiz.

[Rech. Poiss. Foss. vol. iii. 1838, p. 110.]

Syn. *Homalodus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 481.

Astrabodus, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. 1884, p. 629.

Teeth quadrate, more or less elongated, rarely nearly square;

[1] Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 478, pl. lviii. fig. 24.

root much thicker than the crown, and readily detached from the latter. Coronal surface generally marked by transverse rugæ. The exterior postero-lateral angle of each tooth is somewhat produced backwards, to ensure more firm articulation with the succeeding tooth: and there appear to have been not more than four antero-posterior rows in each jaw—a middle pair and a lateral, without any median azygous series.

Psammodus rugosus, Agassiz.

1838. *Psammodus rugosus*, L. Agassiz, Poiss. Foss. vol. iii. p. 111, pl. xii. figs. 14–18, pl. xix. fig. 15.
1838. *Psammodus porosus*, L. Agassiz, *tom. cit.* p. 112, pl. xiii. figs. 1–18.
1843. *Psammodus rugosus*, J. E. Portlock, Rep. Geol. Londonderry, p. 465, pl. xiv *a*, fig. 1.
1843. *Psammodus porosus*, J. E. Portlock, *op. cit.* p. 466, pl. xiv *a*, fig. 2.
1844. *Psammodus rugosus*, L. G. de Koninck, Descr. Anim. Foss. Terr. Carb. Belg. p. 616, pl. lv. fig. 4.
1844. *Psammodus porosus*, L. G. de Koninck, *op. cit.* p. 616, pl. liii. fig. 8.
1848. *Psammodus canaliculatus*, F. M'Coy, Ann. & Mag. Nat. Hist. [2] vol. ii. p. 122.
1855. *Psammodus canaliculatus*, F. M'Coy, Brit. Palæoz. Foss. p. 643, pl. 3 G, fig. 12.
1855. *Psammodus rugosus*, F. M'Coy, *op. cit.* p. 644.
1855. *Psammodus rugosus*, var. *porosus*, F. M'Coy, *op. cit.* p. 644.
1860. *Psammodus porosus*, E. d'Eichwald, Lethæa Rossica, vol. i. p. 1547.
1862. *Psammodus rugosus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 102.
1864. *Psammodus rugosus*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 158, pl. iii. figs. 3, 5.
1864. *Psammodus porosus*, H. Romanowsky, *tom. cit.* p. 158, pl. iii. fig. 4.
1875. *Psammodus porosus*, W. H. Baily, Figs. Char. Brit. Foss. p. 120, pl. xli. fig. 9.
1877. *Psammodus rugosus*, R. Etheridge, jun., Geol. Mag. [2] vol. iv. p. 308, pl. xiii. figs. 7–9.
1878. *Psammodus porosus*, L. G. de Koninck, Faune Calc. Carb. Belg. pt. i. p. 41, pl. v. figs. 1–5.
1883. *Psammodus rugosus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 459, pls. lvi., lvii.
1884. *Psammodus rugosus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 629.
1886. *Psammodus rugosus*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 156.

Type. Detached teeth; Bristol and British Museums.

A very large species. Teeth comparatively thick; the coronal surface in unworn specimens marked by numerous strong, coarse,

transverse rugæ. Complete dentition apparently consisting of a median pair of teeth, generally broader than long, with a lateral pair considerably longer than broad.

As shown by J. W. Davis, *loc. cit.*, the teeth of this species vary much in form—some having a convex coronal surface, some concave; some broader than long, raised at each narrow extremity, others longer than broad, with similarly raised lateral margins (*C. canaliculatus*, M'Coy); some nearly triangular in shape. The differences between these various forms are as great as many considered to be of specific value in other cases; but all the varieties, except one, are fortunately unnamed, and it seems advisable, upon present evidence, to recognize only a single species.

Form. & Loc. Carboniferous Limestone: Ireland, Scotland, England, Wales, Belgium, Russia.

(i.) *Co. Sligo, Ireland; Enniskillen Collection.*

P. 2555. Type specimen described and figured by Agassiz, *loc. cit.* p. 111, pl. xix. fig. 15; Easky.

P. 4163. Crown of much abraded broad tooth; Ballisodare.

(ii.) *Armagh, Ireland; all from the Enniskillen Collection, unless otherwise stated.*

P. 2556. Large transversely elongated tooth, figured by J. W. Davis, *loc. cit.* pl. lvi. fig. 1.

P. 2562. Large tooth, longer than broad, figured *loc. cit.* pl. lvii. fig. 6.

P. 2563. Detached abraded crown, figured *loc. cit.* pl. lvii. fig. 5.

P. 2561. Abraded small tooth, broader than long, figured *loc. cit.* pl. lvii. fig. 4.

P. 2559, 60, P. 2564. Lateral teeth, figured *loc. cit.* pl. lvii. figs. 2, 3, 7. Upon the original label the third of these teeth is said to have been obtained from the Orton Scar Limestone, Ravenstone Dale, Westmoreland.

P. 2566. Thirty-four teeth of large size, more or less perfect.

P. 2567. Four fragmentary teeth, with strong rugose ornament, said to have been found associated.

P. 4162. The finely ornamented crowns of seven broad teeth.

P. 2546. Fifteen large broad teeth, with much abraded coronal surface.

P. 2572. Twelve small broad teeth, somewhat abraded.

P. 2547–50, P. 2578. Thirty-nine broad abraded teeth, mostly small.

P. 2547 a. Abraded specimen showing portion of original coronal surface.

P. 2552. Six very narrow abraded teeth (? partly fragmentary) of irregular outline.

28536, 28742, 43, 28923, 4. Twenty-five broad teeth, some abraded and some broken, and two polished transverse sections. Also two lateral teeth.
Dixon Coll., and Purchased, 1853.

P. 1312, P. 1315, 6. Fifteen broad teeth, some abraded, some broken. *Egerton Coll.*

P. 1312 a, P. 1315 a. Four lateral teeth. *Egerton Coll.*

P. 2551 a, P. 2571. Fifteen large lateral teeth, the two of the first number remarkably thick.

P. 2551, P. 2553, P. 2568–70. About eighty examples of lateral teeth.

P. 2576, 7. Two specimens figured by J. W. Davis, *loc. cit.* pl. lvi. figs. 2, 3; Tynan, Armagh.

P. 2575. Fine unabraded broad tooth, detached from matrix; Tynan, Armagh.

(iii.) *Hook Point, Wexford, Ireland.*

23712. Two small, much abraded broad teeth. *Purchased*, 1849.

P. 4161. Another equally small broad tooth. *Enniskillen Coll.*

P. 1478. A lateral tooth of corresponding size. *Egerton Coll.*

(iv.) *Beith, Ayrshire, Scotland.*

P. 257. Typical example of broad tooth, somewhat abraded: Langside. *Purchased*, 1880.

46037. Small much abraded specimen.
Presented by Robert Craig, Esq., 1874.

46034. Fine tooth, as broad as long, with ornament as in No. 49623.
Presented by Robert Craig, Esq., 1874.

(v.) *Kendal, Westmoreland.*

P. 2566. Two large broad teeth, with very coarse ornament, slightly abraded. *Enniskillen Coll.*

P. 4158. Detached abraded crowns of four smaller teeth.
Enniskillen Coll.

P. 1314. Portion of unabraded crown of very large tooth.
Egerton Coll.

35662. Crushed and abraded lateral tooth. *Purchased*, 1859.

(vi.) *Richmond, Yorkshire.*

49623. Tooth longer than broad, much abraded, and partly broken. The superficial ornamentation passes posteriorly into prominent coarse longitudinal rugæ. *Purchased*, 1878.

(vii.) *Derbyshire.*

46813. Much abraded broad tooth, of medium size, detached from matrix. *Gilbertson Coll.*

P. 5364. Three fragments; Ticknall. *Wilson Coll.*

(viii.) *Clifton, Bristol.*

P. 2557. Broad tooth, much abraded, figured by J. W. Davis, *loc. cit.* pl. lvi. fig. 5. *Enniskillen Coll.*

P. 2558. Much abraded fragment of tooth, triangular in form, figured *loc. cit.* pl. lvi. fig. 7. *Enniskillen Coll.*

P. 2574. Three large unabraded dental crowns (one from the "Black Rock") very broad. *Enniskillen Coll.*

34966–68, 20825. Four broad teeth, moderately large, scarcely abraded. Two of the specimens show the coronal protuberance noted by J. W. Davis in no. P. 2557.
Purchased, 1847, 1860.

49985. Very large tooth, as broad as long, much abraded; the superficial ornament posteriorly becoming well-marked longitudinal ridges and furrows. *Purchased*, 1879.

49986. Abraded broad tooth. *Purchased*, 1879.

P. 2554. Four much abraded specimens from the "Black Rock;" one of the type of no. 49985, another very broad, the two others narrowed at one extremity. *Enniskillen Coll.*

34969, 34970. Two abraded examples of medium size, the one of the type of P. 2557, the other ornamented like no. 49985. *Purchased*, 1860.

P. 1313, P. 1316. Fourteen broad specimens, mostly abraded. *Egerton Coll.*

44851. Three similar much abraded and somewhat broken specimens. *Presented by Benjamin Bright, Esq.*, 1873.

20575, 34971, 36306, 7. Five broken and abraded examples. *Purchased*, 1846, 1860, 1861.

20828. Eleven small specimens, mostly fractured and abraded. *Purchased*, 1847.

20828 a. One small specimen from the "Black Rock," polished to show structure. *Purchased*, 1847.

P. 5224. Three imperfect examples. *Presented by J. E. Lee, Esq.*, 1885.

P. 1316 a. Three lateral teeth. *Egerton Coll.*

20828 b. Six small abraded elongate teeth, each tapering at one extremity. One example shows a very thick root. *Purchased*, 1847.

P. 2565. Two similar but larger specimens. *Enniskillen Coll.*

(ix.) *Clevedon, Somersetshire.*

P. 4160. Specimen of medium size, slightly broader than long. *Enniskillen Coll.*

(x.) *North Wales.*

P. 5365. Small abraded tooth, detached from matrix; Crags near Llangollen. *Wilson Coll.*

Psammodus expansus (Davis).

1884. *Astrabodus expansus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 630, pl. xxvi. figs. 11, 12.

Type. Imperfect teeth; Horne Coll., York Museum.

Teeth somewhat saddle-shaped, broader than long. Near the outer lateral margin the crown is raised into a prominent ridge, which extends backwards as a process beyond the remainder of the posterior border.

Form. & Loc. Upper Carboniferous Limestone (Yoredale Rocks): Yorkshire.

P. 4903. Fragmentary abraded tooth; Wensleydale. *Horne Coll.*

Psammodus salopiensis, sp. nov.

1862. *A palate, or part of a palate*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 105, pl. iii. fig. 5.

Type. Four associated teeth, in natural relative positions; British Museum.

A small species. Teeth comparatively thick; the inner two thirds of the crown round and tumid, rapidly thinning outwards laterally.

Form. & Loc. Carboniferous Limestone (zone of *Rhynchonella pleurodon*): Farlow, Shropshire.

36469. Type specimen, figured, of the natural size, by Morris and Roberts, *loc. cit.* Two symmetrical pairs of teeth are shown, one behind the other. Of one pair each tooth is approximately as broad as long, while of the succeeding (or preceding) pair the length equals only about two thirds of the breadth. The appearance of tapering both anteriorly and posteriorly is due to accidental fracture.

Presented by G. E. Roberts, Esq., 1862.

Psammodus trapeziformis (Davis).

1883. *Homalodus trapeziformis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 482, pl. lviii. fig. 30.

1883. *Homalodus quadratus*, J. W. Davis, *tom. cit.* p. 482, pl. lviii. fig. 31.

Type. Detached tooth; British Museum.

The teeth are comparatively thin, though the root attains about twice the thickness of the crown; the coronal surface seems to have been flat, smooth, and punctate. The length and breadth of each

tooth are approximately equal, the latter measurement sometimes slightly exceeding the former.

The third of the specimens mentioned below is intermediate between the types of *H. trapeziformis* and *H. quadratus*, which it seems inadvisable to separate specifically. All are from the Enniskillen Collection.

Form. & Loc. Lower Carboniferous Limestone : Armagh.

P. 2599. Type of *Homalodus trapeziformis*, Davis.

P. 2600. Type of *H. quadratus*, Davis.

P. 5323. Tooth intermediate between the foregoing.

P. 5324. Smaller tooth, probably referable to the same species.

Psammodus angustus, Romanowsky.

1864. *Psammodus angustus*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 159, pl. iii. fig. 6.

1874. *Psammodus angustus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. p. 289, pl. xxviii. fig. 5.

1878. *Psammodus angustus*, L. G. de Koninck, Faune Calc. Carb. Belg. pt. i. p. 45, pl. v. fig. 6.

Type. Detached tooth.

The coronal surface of unworn and unabraded teeth is probably rugose, though the majority of the fossils only show such markings upon the sides. The inner teeth are mostly about two and a half times as broad as long, the crown exhibiting a tumid rising towards its outer lateral extremity, where it is produced into a downwardly-directed plate extending over the root. The root is scarcely as thick as the crown, and likewise bent downwards at the lateral extremity.

Trautschold mentions the occurrence of small square teeth of *Psammodus* in the same bed as the remains of the present species ; and these may probably be regarded as lateral teeth, like those of *P. rugosus*.

Form. & Loc. Lower Carboniferous Limestone : Alexine, Government of Toula, and Mjatschkowa, Government of Moscow, Russia ; Feluy, Belgium.

P. 4485. Five detached dental crowns and one complete tooth : Mjatschkowa. *Purchased*, 1884.

P. 5112. Two detached dental crowns and one almost complete tooth ; Mjatschkowa. *Purchased*, 1886.

Psammodus specularis, Trautschold.

1874. *Psammodus specularis*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. p. 288, pl. xxviii. fig. 4.

Type. Detached tooth.

The coronal surface of the fossil teeth is smooth, though, as these are all more or less abraded, it may have originally been rugose. The inner teeth are about two and a half times as broad as long, and somewhat twisted round the long axis. The crown is nearly twice as thick as the root, and is not downwardly bent at either extremity.

As already remarked by Trautschold, it is not improbable that these teeth may be truly referable to *P. angustus*, being perhaps the opposing teeth to those described under the last-named species. The distinctness of their shape, however, renders it convenient to separate them until further evidence as to their relationships is discovered.

Form. & Loc. Lower Carboniferous Limestone: Mjatschkowa, Government of Moscow, Russia.

P. 4486. Four teeth and one detached crown. *Purchased*, 1884.

P. 5113. Two detached dental crowns, of large size. *Purchased*, 1886.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Psammodus angularis, Newberry and Worthen, Pal. Illinois, vol. ii. (1866), p. 107, pl. xi. fig. 2. (?) "*P. porosus* Agassiz," ibid. p. 107, pl. xi. fig. 1; *P. angularis*, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 222, pl. xix. figs. 1, 2.—Chester Limestone; Illinois.

Psammodus calvatus, St. John & Worthen, *op. cit.* vol. vii. (1883), p. 217, pl. xviii. fig. 1.—St. Louis Limestone; Iowa.

Psammodus crassidens, St. John & Worthen, *op. cit.* vol. vii. (1883), p. 218, pl. xviii. figs. 2–6; *P. rugosus*, Newberry & Worthen (*non* Agassiz), *op. cit.* vol. ii. p. 108, pl. xi. fig. 3.—St. Louis Limestone; Illinois, Iowa.

Psammodus glyptus, St. John & Worthen, *tom. cit.* p. 209, pl. xiv. figs. 5, 6.—Upper Burlington Limestone; Illinois.

Psammodus grandis, St. John & Worthen, *tom. cit.* p. 211, pl. xv. figs. 1–3.—Keokuk Limestone: Iowa.

Psammodus inflexus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat.

Moscou, vol. xiii. (1874). p. 271, pl. xxvii. fig. 12; *Helodus*, P. Semenow & W. von Möller, Bull. Acad. Imp. Sci. St. Pétersb. vol. vii. (1864), p. 235, pl. i. fig. 9.—Lower Carboniferous Limestone (L. G. de Koninck) or Upper Devonian (Trautschold); Government of Toula, Russia.

Psammodus lucianus, St. John & Worthen, *tom. cit.* p. 207, pl. xiv. figs. 7–9.—**Burlington Limestone; Iowa, Illinois.**

Psammodus plenus, St. John & Worthen, *tom. cit.* p. 213, pl. xvi. figs. 1–4, pl. xvii. figs. 1–4.—St. Louis Limestone; **Missouri, Illinois, Michigan.**

Psammodus reticulatus, Newberry & Worthen, *tom. cit.* p. 109, pl. xi. fig. 5; St. John & Worthen, *tom. cit.* p. 224, pl. xix. **figs. 3, 5.—Chester Limestone; Illinois.**

Psammodus springeri, St. John & Worthen, *tom. cit.* p. 202, pl. xx. figs. 4–11.—Upper Burlington Limestone; Iowa, Illinois.

Psammodus tumidus, St. John & Worthen, *tom. cit.* p. 205, pl. xiv. figs. 1–4.—Upper Burlington Limestone; Iowa, Illinois.

Psammodus turgidus, St. John & Worthen, *tom. cit.* p. 206, pl. xv. fig. 4.—**Upper Burlington-Kookuk Limestone; Iowa.**

It is also uncertain whether the tooth described under the following name may not be referred to a lateral position in the jaw of *Psammodus*:—

Solenodus crenulatus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. **Moscou, vol. xiii. (1874), p. 293, pl. xxviii. fig. 11.—Carboniferous Limestone; Moscow, Russia.**

An indeterminable tooth from the Rhætic of Stuttgart, certainly not of *Psammodus*, is described under the name of *P. orbicularis*, Plien. (Meyer & Plieninger, Pal. Württemb., 1844, p. 117, pl. x. fig. 24).

Genus **ARCHÆOBATIS,** Newberry.

[Ann. New York Acad. Sci. vol. i. 1878, p. 190.]

"Dentition flat and pavement-like: teeth of large size, thick and massive, in several rows, the different series arched and increasing in size from behind forward: under surfaces somewhat excavated to fit the curvature of the cartilaginous jaw; upper third of teeth formed by a coat of enamel, transversely corrugated and punctate."

Archæobatis gigas, J. S. Newberry, *loc. cit.* p. 191; also in Ann. Rep. Geol. Surv. Indiana, 1879, p. 347.—St. Louis Limestone; **Greencastle, Indiana.**

Family MYLIOBATIDÆ.

Pectoral fins of very large size, interrupted at the sides of the head, but reappearing as one or a pair of small cephalic fins at the extremity of the snout. Tail very slender. Cleft of mouth straight, and dentition, when present, in the form of a triturating pavement.

Genus **MYLIOBATIS,** Cuvier.

[Règne Animal, vol. ii. 1817, p. 137.]

Head free from the disk; so-called cephalic fin single. Teeth large, flat, sexangular, tessellated, arranged in seven antero-posterior series. The dentition of the upper jaw strongly arched antero-posteriorly, that of the lower jaw quite flat. Dental crown smooth or slightly striated; attached surface of root longitudinally ridged and grooved. Except in very young individuals—in which the teeth are all approximately of equal size—the median row is relatively very broad, while the teeth of the three lateral series on each side are rarely broader than long. Tail with a dorsal fin near its root, generally with a posteriorly situated barbed spine.

The relative proportions of the median teeth vary with the age (or size) of the individual, the breadth gradually becoming greater with respect to the length, and in determining the fossil teeth it is necessary to allow for this change[1].

Myliobatis dixoni, Agassiz.

1843. *Myliobatis dixoni*, L. Agassiz, Poiss. Foss. vol. iii. p. 319.

1843. *Myliobatis latecaudatus*, L. Agassiz, *tom. cit.* p. 323, pl. xlvii. figs. 6–8.

1850. *Myliobatis dixoni*, F. Dixon, Foss. Suss. p. 198, pl. x. figs. 1, 2, pl. xi. fig. 14, pl. xii. fig. 3.

1850. *Myliobatis contractus*, F. Dixon, *op. cit.* p. 200. pl. xi. fig. 17.

1850. *Myliobatis striatus*, F. Dixon (*non* Agass.), *op. cit.* pl. xii. fig. 2.

(?) 1859. *Myliobatis de Cuise Lamotte*, P. Gervais, Pal. Franç. 2nd ed. pl. lxvii. fig. 14.

1883. *Myliobatis dixoni*, H. B. Geinitz, Abh. naturw. Ges. Isis, Dresden, p. 6. pl. i. fig. 7.

1883. *Myliobatis toliapicus*, H. B. Geinitz (*non* Agass.), *loc. cit.* p. 38, pl. ii. fig. 2.

1888. *Myliobatis dixoni*, A. S. Woodward, Ann. & Mag. Nat. Hist. [6] vol. i. p. 41, pl. i. figs. 1–4.

[1] See Ann. & Mag. Nat. Hist. [6] vol. i. 1888, pp. 36–47, pl. i.

Type. Upper dental plates; British Museum.

Teeth very massive, the coronal contour transversely arched, especially in the upper jaw. Longitudinal superficial striæ well marked in unabraded specimens. Median teeth in the adult rarely or never more than five times as broad as long; lateral teeth much longer than broad.

The specimens figured respectively under the names of *M. contractus*, *M. striatus*, and *M. toliapicus*, by Dixon and Geinitz, *loc. cit.*, are examples of the lower dentition of *M. dixoni*: so also probably is the type specimen of *M. heteroplcurus*, Agassiz. Numerous measurements of the teeth at various stages of growth are given by the present writer, *loc. cit.*

Form. & Loc. Barton Clay (Upper Eocene): Hampshire. Bracklesham Beds (Middle Eocene): Sussex. Phosphate Beds (Middle or Upper Eocene): Helmstedt, near Harzburg, Brunswick. (?) Lower Eocene: Cuise-la-Motte, Oise, France.

Upper Dentition.—Bracklesham Beds, Bracklesham Bay.

25614, 25621, 25623, P. 434. Type specimens figured by Dixon, *op. cit.*, and noticed by the present writer, *loc. cit.* p. 41. *Dixon Coll.*, and (P. 434) *Purchased*, 1882.

25644. Abnormal specimen, having the lateral plates in the form of irregular parallelograms, referred to by Dixon, *op. cit.* p. 198. *Dixon Coll.*

25645–6, 25648–9, 25654. Plates in connected series. *Dixon Coll.*

25664. A very fine connected series of nine median teeth, with two lateral rows on each side; the unworn surface is somewhat longitudinally striated and wrinkled. *Dixon Coll.*

38839, 38841–46. Plates in connected series. The first specimen is noticed by the present writer, *loc. cit.* p. 41. *Bowerbank Coll.*

P. 435, P. 437. Six examples. *Purchased*, 1882.

P. 5384. Four medium-sized specimens. *Presented by P. E. Coombe, Esq.*, 1888.

P. 1496, P. 1498, P. 1498 a, P. 1504 a, P. 1507 c, P. 1509. Twenty examples. No. P. 1498 *a* is noticed by the present writer, *loc. cit.* p. 41. *Egerton Coll.*

P. 3044, P. 3044 a–c. Twelve examples. Nos. P. 3044 *a*, *b*, are noticed by the present writer, *loc. cit.* p. 41. *Enniskillen Coll.*

28082. Five median teeth in connected series, very small.
Presented by F. E. Edwards, Esq., 1852.

P. 4457 a. Six small examples of median teeth. *Enniskillen Coll.*

Lower Dentition.—(i.) Bracklesham Beds, Bracklesham Bay.

25641. Connected series of seven median teeth, with parts of two rows of lateral teeth, of adult, described and figured by the present writer, *loc. cit.* p. 42, pl. i. fig. 4. A transverse section of the dentition is shown in the accompanying woodcut (fig. 4). *Dixon Coll.*

Fig. 4.

Transverse section of lower dentition of *Myliobatis dixoni* (no. 25641).

25642. Much abraded adult specimen. *Dixon Coll.*

P. 4458. Connected series of five median teeth, with parts of two lateral rows, of a larger individual than the preceding, noticed *loc. cit.* p. 42. *Enniskillen Coll.*

25821. Specimen figured by Dixon, *op. cit.* pl. xii. fig. 2, as *M. striatus*. *Dixon Coll.*

25620. Type specimen of *M. contractus*, Dixon, *op. cit.* p. 200, pl. xi. fig. 17. *Dixon Coll.*

25630. Similar specimen, noticed by the present writer, *loc. cit.* p. 42. *Dixon Coll.*

40255. Similar less perfect specimen. *Edwards Coll.*

P. 1505 b. Another small example. *Egerton Coll.*

37758. Somewhat larger specimen, noticed *loc. cit.* p. 42.
Purchased, 1863.

P. 438. Specimen described and figured by the present writer, *loc. cit.* p. 42, pl. i. fig. 2. *Purchased*, 1882.

(ii.) Barton Clay, Barton Cliff, Hampshire.

P. 1496, P. 1508 a. Two connected series of five median teeth, with two lateral rows: the second is described and figured *loc. cit.* p. 42, pl. i. fig. 3. *Egerton Coll.*

P. 1508 b. Fragment of very large dentition. *Egerton Coll.*

P. 4457 c. Fragment of young dentition, described and figured *loc. cit.* p. 42, pl. i. fig. 1. *Enniskillen Coll.*

P. 3051. Type specimen of *M. heteropleurus*, Agassiz, *loc. cit.* p. 323, pl. xlvii. figs. 6–8; locality unknown. *Enniskillen Coll.*

Myliobatis striatus, Buckland.

1837. *Myliobatis striatus*, W. Buckland, Geol. & Min. 2nd edit. vol. ii. p. 46, pl. xxvii. *d*, fig. 14 (name and figure only).
1843. *Myliobatis striatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 320.
1843. *Myliobatis punctatus*, L. Agassiz, *tom. cit.* p. 322, pl. xlvii. figs. 11, 12.
1850. *Myliobatis irregularis*, F. Dixon, Foss. Suss. p. 199, pl. xi. fig. 15.
1850. *Myliobatis edwardsii*, F. Dixon, *op. cit.* p. 199, pl. xi. fig. 16.
(?) 1885. *Myliobatis toliapicus*, F. Noetling (*non* Agassiz), Abh. geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3, p. 19, pl. ii. fig. 1.
1888. *Myliobatis striatus*, A. S. Woodward, Ann. & Mag. Nat. Hist. [6] vol. i. p. 42, pl. i. figs. 5–9.

Type. Lower dentition; Oxford Museum.

Dentition large and thick, the coronal contour slightly arched from side to side, almost flat in the adult lower jaw. Longitudinal superficial striæ or wrinkles generally well marked in unabraded specimens. Median teeth in the adult at least six times as broad as long; lateral teeth longer than broad, but those of the first row not so elongate as in *M. dixoni*.

Horiz. & Loc. Barton Clay (Upper Eocene): Hampshire. Bracklesham Beds (Middle Eocene): Sussex.

Upper Dentition.—Some of these specimens must pertain to *M. goniopleurus*, others perhaps to *M. toliapicus*. Unless otherwise stated, they were all obtained from the Bracklesham Beds, Bracklesham Bay.

25671. Fragment of dentition of very young individual, remarkably thick, and showing three lateral rows of teeth: figured by the present writer, *loc. cit.* p. 44, pl. i. fig. 10. *Dixon Coll.*

25647, 25653, 25659. Three connected series of median teeth, very young; the third is noticed *loc. cit.* p. 44. *Dixon Coll.*

P. 4457 b. Connected series of five median teeth, and two lateral rows, unabraded; very young individual.
Enniskillen Coll.

25662. Small crushed median teeth, with three first laterals.
Dixon Coll.

38849. Connected series of six median teeth, with abraded surface.
Bowerbank Coll.

40257, 40312 3. Four examples of median teeth in series; the second and third specimens are noticed, *loc. cit.* p. 44.
Edwards Coll., and *Purchased*, 1867.

25643. Connected series of seven large median teeth, probably referable to this species. *Dixon Coll.*

P. 1501. Type specimen of *M. punctatus*, Agassiz; Barton Clay, Barton Cliff, Hampshire. The punctated coronal surface owes its characters to post-mortem abrasion, and the proportions of the teeth agree with those of *M. striatus*.
Egerton Coll.

P. 1505 c, P. 1507 e. Seven examples, very young. *Egerton Coll.*

P. 1502. Two examples, one showing seven median plates, with first lateral row; noticed by the present writer, *loc. cit.* p. 44. *Egerton Coll.*

P. 3046. Connected series of six median teeth; Barton Clay, Barton Cliff. *Enniskillen Coll.*

P. 3047. Connected series of six median teeth, showing unworn surface; noticed, *loc. cit.* p. 44. *Enniskillen Coll.*

40253. Fragments of four median teeth; Alum Bay, Isle of Wight.
Edwards Coll.

P. 5388. Two abraded specimens, retaining part of the original coronal surface, one showing portions of two lateral series of teeth. *Presented by P. E. Coombe, Esq.*, 1888.

Lower Dentition.—Bracklesham Beds, Bracklesham Bay.

P. 433. Type specimen of *M. irregularis*, Dixon.
Purchased, 1882.

25665–7. Three adult examples, showing two lateral rows in addition to median teeth: the second and third are noticed by the present writer, *loc. cit.* p. 43. *Dixon Coll.*

40252. Specimen figured by the present writer, *loc. cit.* pl. i. fig. 9. A transverse section of this fossil is shown in the accompanying woodcut, fig. 5. *Edwards Coll.*

Fig. 5.

Transverse section of lower dentition of *Myliobatis striatus* (No. 40252).

38838, 39245. Two large specimens; the first figured *loc. cit.* pl. i. fig. 8. *Bowerbank Coll.*

P. 3040. One large example, showing 14 median teeth, flanked by two imperfect lateral series; noticed, *loc. cit.* p. 43. *Enniskillen Coll.*

24843. Medium-sized abraded specimen. *Purchased*, 1850.

P. 1504. Medium-sized specimen, with striated surface partly preserved. *Egerton Coll.*

P. 1507 a, b. Three very small examples probably referable to this species; two are figured, *loc. cit.* pl. i. figs. 5, 6. *Egerton Coll.*

P. 1507. Five small specimens. *Egerton Coll.*

P. 1505. One small specimen. *Egerton Coll.*

25615. Type specimen of *M. edwardsii*, Dixon; evidently the abraded dentition of a half-grown individual of *M. striatus*. *Dixon Coll.*

25631–4, 25822. Five specimens, four about the size of the so-called *M. edwardsii*, two smaller. *Dixon Coll.*

28082 a. Another similar specimen. *Presented by F. E. Edwards, Esq.*, 1852.

P. 3043. Unabraded specimen showing three rows of lateral teeth; noticed, *loc. cit.* p. 43. The lateral teeth are broader than ordinarily, though not equalling the breadth of those of *M. toliapicus*. *Enniskillen Coll.*

P. 3041, P. 3048, P. 4457, P. 4459–60, P. 4461 a. Eleven examples about the size of *M. edwardsii*. *Enniskillen Coll.*

P. 3049 a. Specimen figured by the present writer, *loc. cit.* pl. i. fig. 7. *Enniskillen Coll.*

P. 4461 b. Two very young specimens. *Enniskillen Coll.*

P. 5386. Twelve examples, of various sizes, some with two rows of lateral teeth. *Presented by P. E. Coombe, Esq.*, 1888.

Myliobatis goniopleurus, Agassiz.

1843. *Myliobatis goniopleurus*, L. Agassiz, Poiss. Foss. vol. iii. p. 319, pl. xlvii. figs. 9, 10.

1888. *Myliobatis goniopleurus*, A. S. Woodward, Ann. Mag. Nat. Hist. [6] vol. i. p. 44.

Type. Abraded lower dentition; British Museum.

Teeth of similar proportions to those of *M. striatus*; lower dentition differing in the greater thickness and more raised contour of the crown (see Pl. III. fig. 5 *a*).

The second of the specimens mentioned below seems to afford the requisite proof of the distinctness of this species from *M. striatus*, noted as wanting at the time of publication of the present writer's memoir, *loc. cit.* All these specimens represent the lower dentition, that of the upper jaw being at present indistinguishable from the corresponding dentition of *M. striatus*.

Form. & Loc. London Clay (Lower Eocene): Isle of Sheppey. Bracklesham Beds (Middle Eocene): Bracklesham Bay.

P. 3045. Type specimen; Sheppey. *Enniskillen Coll.*

P. 5387. Connected series of eleven median teeth, with portions of two rows of lateral teeth on one side, and three on the other, mostly abraded, but in part showing the original coronal surface; Bracklesham. A portion of the specimen is represented, of the natural size, in Pl. III. fig. 5, and the coronal contour is given in the section, fig. 5 *a*. The median teeth measure 0·05 by 0·007–0·009, and are slightly curved antero-posteriorly.
Presented by P. E. Coombe, Esq., 1888.

P. 5385. Three imperfect abraded series of median teeth, with a few first lateral; Bracklesham. The median teeth measure respectively, 0·021 by 0·005, 0·032 by 0·007, and 0·038 by 0·008. *Presented by P. E. Coombe, Esq.*, 1888.

38837. Series of five median teeth, with portions of two lateral rows; Bracklesham. *Bowerbank Coll.*

43102. Abraded series of seven median teeth, with portions of two lateral series on each side; Bracklesham. The median teeth measure 0·031 by 0·007. *Wetherell Coll.*

25663. A very similar, but slightly larger specimen: Bracklesham. *Dixon Coll.*

P. 1505 a, P. 1505 b, P. 1507 d. Three small specimens: Bracklesham. The first is referred to *M. striatus* by the present writer, *loc. cit.* p. 43. *Egerton Coll.*

P. 3049, P. 4457 d, e. Four medium-sized examples: Bracklesham. The median teeth of the largest measure 0·037 by 0·008. *Enniskillen Coll.*

Myliobatis toliapicus, Agassiz.

1843. *Myliobatis toliapicus*, L. Agassiz, Poiss. Foss. vol. iii. p. 321, pl. xlvii. figs. 15–20.

1843. *Myliobatis suturalis*, L. Agassiz, *tom. cit.* p. 322, pl. xlvi. figs. 12–16.

1843. *Myliobatis nitidus*, L. Agassiz, *tom. cit.* p. 325.

1847. *Myliobatis striatus*, R. Owen (*non* Agassiz), Ann. Mag. Nat. Hist. [1] vol. xix. p. 25, woodcut.

(?) 1850. *Myliobatis toliapicus*, F. Dixon, Foss. Suss. p. v, pl. x. figs. 3–5.

1888. *Myliobatis toliapicus*, A. S. Woodward, Ann. Mag. Nat. Hist. [6] vol. i. p. 45.

Type. Lower dentition; British Museum.

Dentition comparatively thin, the coronal contour flat in the lower jaw, nearly so in the upper. Longitudinal superficial striæ scarcely apparent. Median teeth in the adult at least six times as broad as long; lateral teeth as broad as long, more or less diamond-shaped.

Form. & Loc. Barton Clay (Upper Eocene): Hampshire. Bracklesham Beds (Middle Eocene): Sussex. London Clay (Lower Eocene): Isle of Sheppey. Lower Eocene: Belgium.

Upper Dentition.—(i.) London Clay, Isle of Sheppey.

P. 1494. Connected series of nine median teeth, with remains of three lateral rows. *Egerton Coll.*

30892. Much abraded specimen, with fragments of cartilage. *Purchased*, 1856.

P. 1506 a. Connected series of seven median plates, with remains of two lateral rows. *Egerton Coll.*

P. 528. Connected series of six median teeth, probably belonging to a young individual of this species, named *M. nitidus* by Agassiz, *loc. cit.* It is described by the present writer, *loc. cit.* p. 45. *Egerton Coll.*

(ii.) Bracklesham Beds, Bracklesham Bay.

P. 436 a. Two series of small median teeth. *Purchased*, 1882.

40254. Connected series of six median teeth, young.
Edwards Coll.

25658. Connected series of five median teeth, with two of the first lateral row; coronal surface mostly much abraded, having the appearance described by Agassiz in the so-called *M. punctatus*. *Dixon Coll.*

P. 1507 f. Three median teeth, with the first lateral row of each side, belonging to a very young individual either of this species or *M. striatus*. Each median tooth measures approximately 0·011 m. by 0·002 m. *Egerton Coll.*

Lower Dentition.—(i.) London Clay, Isle of Sheppey.

P. 3038. Type specimen. *Enniskillen Coll.*

28764. Connected series of nine median teeth, with remains of two lateral rows. *Purchased*, 1853.

P. 3042. Very large specimen, with first lateral row broad and irregular; noticed by the present writer, *loc. cit.* p. 45.
Enniskillen Coll.

35693. Fragmentary dentition of young individual.
Purchased, 1859.

(ii.) Bracklesham Beds, Bracklesham Bay.

25669–70, 25672. Three examples of moderate size, and one small; the first is noticed, *loc. cit.* p. 45. *Dixon Coll.*

38850–54. Five fine specimens; the last noticed, *loc. cit.* p. 45.
Bowerbank Coll.

25613. Specimen figured by Dixon, *op. cit.* pl. x. figs. 3, 4.
Dixon Coll.

P. 3039. Connected series of 13 median teeth, with two lateral rows on each side. *Enniskillen Coll.*

P. 1505. Three fragmentary examples. *Egerton Coll.*

P. 1505 c, P. 1507 c. Two small specimens; noticed, *loc. cit.* p. 45.
Egerton Coll.

P. 436. Small abraded connected series of seven median teeth.
Purchased, 1882.

P. 5426. Two small specimens.
Presented by P. E. Coombe, Esq., 1888.

(iii.) Barton Clay, Barton Cliff.

P. 1500. Connected series of 12 median teeth, with two lateral rows on each side. *Egerton Coll.*

(iv.) Lower Eocene, near Brussels, Belgium.

42856. Connected series of six median teeth, with two lateral rows. *Van Breda Coll.*

P. 1510. Fragment of dentition, showing three lateral rows of teeth. *Egerton Coll.*

Myliobatis latidens, A. S. Woodward.

1888. *Myliobatis latidens*, A. S. Woodward, Ann. Mag. Nat. Hist. [6] vol. i. p. 45, pl. i. figs. 11, 12.

Type. Lower dentition; British Museum.

A small species. Coronal contour of lower dentition flat, that of the upper only slightly transversely arched. Median teeth in adult not less than eight times as broad as long; lateral teeth at least as broad as long.

Form. & Loc. Bracklesham Beds (Middle Eocene): Sussex.

25630 a. One of the type specimens; figured, *loc. cit.* pl. i. fig. 12. *Dixon Coll.*

P. 1507 g. Second type specimen; figured, *loc. cit.* pl. i. fig. 11. *Egerton Coll.*

25630, 25637, 25672. Three similar specimens, the second showing two series of lateral teeth on each side. *Dixon Coll.*

P. 1506 a. Abraded series of six median teeth of large individual; referred to, *loc. cit.* p. 46. *Egerton Coll.*

25656. Portion of upper dentition doubtfully assigned to this species; figured, *loc. cit.* pl. i. fig. 13. *Dixon Coll.*

The two species *M. gyratus* and *M. jugalis*, ascribed by Agassiz[1] to the London Clay of Sheppey, are probably founded upon the abraded dentition of one of the foregoing species.

Myliobatis stokesii, Agassiz.

1843. *Myliobatis stokesii*, L. Agassiz, Poiss. Foss. vol. iii. p. 318, pl. xlvii. figs. 1, 2.

Type. Half of lower dentition; British Museum.

Crown of median tooth very thick, though flattened, in the middle

[1] Poiss. Foss. vol. iii. 1843, pp. 323, 324, pl. xlvi. figs. 1–3, pl. xlvii. figs. 13, 14.

portion, rapidly becoming thinner on each side; the extremities of this tooth are more or less backwardly reflexed, and the lateral teeth narrow, six-sided, and somewhat oblique.

Form. & Loc. Miocene: Maltese Islands.

Upper Dentition.

41768. Connected series of seven broken median teeth, measuring 0·039 m. by 0·0055 m. The extremities of the teeth are not so much reflexed as those of the lower jaw.
Purchased, 1869.

P. 1492. Large, much broken specimen, showing portions of ten median teeth and two lateral series, and exhibiting the same characters as the preceding. The median teeth measure 0·057 by 0·0075. *Egerton Coll.*

Lower Dentition.

P. 460. Type specimen. *Egerton Coll.*

43036. Fine example, smaller than the type, showing two lateral rows; Isle of Gozo. The median teeth are reflexed at the extremities, and measure 0·032 by 0·004–0·0055.
Presented by the Rev. Greville Chester, 1871.

Myliobatis angustidens, Sismonda.

1849. *Myliobatis angustidens*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 52, pl. ii. figs. 55, 56.

1877. *Myliobatis angustidens*, A. Issel, Ann. Mus. Civ. Stor. Nat. Genova, vol. x. p. 328.

Type. Lower dentition; School of Engineering, Turin.

Crown of lower dentition flat; median teeth in adult about ten times as broad as long; lateral teeth longer than broad, somewhat oblique.

Form. & Loc. Pliocene: Tuscany.

47030. Six fragments of lateral and median teeth, determined by Lawley to belong to this species; Lower Pliocene, Orciano, Tuscany. *Purchased*, 1875.

Myliobatis (?) tumidens, sp. nov.

An incompletely definable species, probably of *Myliobatis*, is indicated by the following median teeth from the Red Crag of Suffolk. The coronal contour is sharply raised in the middle, as in *M. jugosus*, Leidy, differing only from the latter tooth in the greater relative breadth of the rounded elevation.

P. 5580. Type specimen; a median tooth, measuring nearly 0·05 in breadth and 0·01 in length; much abraded. *Harford Coll.*

44043. Two thirds of median tooth; Woodbridge. *Purchased*, 1873.

30905 a. Fragment of a similar smaller tooth; Woodbridge. *Purchased*, 1856.

Nos. **43315–6** (*Purchased*, 1872) are two abraded thick-crowned median teeth of *Myliobatis* or *Aetobatis*, from the Red Crag of Woodbridge, Suffolk.

The following detached barbed caudal spines appear to be generically indeterminable, and may probably in part be referable to unknown Trygonidæ:—

(i.) Bracklesham Beds, Bracklesham Bay, Sussex.

25701–2. Fragment of "*Myliobatis oweni*, Agass.,"[1] figured in Dixon's Foss. Suss. pl. x. fig. 10. Also two more complete examples. *Dixon Coll.*

28085. One fragmentary specimen similar to the last, and one other smaller. *Presented by F. E. Edwards, Esq.*, 1852.

25702 c. Specimen of *Myliobatis toliapicus*, Agass.[2], figured by Dixon, *op. cit.* pl. x. fig. 36. *Dixon Coll.*

25702 a. Comparatively smooth example. *Dixon Coll.*

25702 b. Fragment of small unabraded spine. *Dixon Coll.*

38861–2. Two fragmentary examples. *Bowerbank Coll.*

P. 1511 a, b. Nearly complete small spines. *Egerton Coll.*

(ii.) Barton Clay, Barton Cliff, Hampshire.

P. 527. Undescribed type specimen of *Myliobatis marginalis*, Agassiz, *tom. cit.* p. 331. *Egerton Coll.*

28878. Nearly complete much larger spine. *Daniels Coll.*

(iii.) Foreign localities.

P. 1512. Base of spine. Eocene, near Brussels. *Egerton Coll.*

36818. Fragment from the Miocene of the Isle of Gozo. *Presented by Prof. A. Leith Adams*, 1862.

P. 1513. Broken fragments from the Eocene of Clarke's Co., Alabama, U.S.A. *Egerton Coll.*

[1] Poiss. Foss. vol. iii. p. 331, pl. xlv. figs. 11–13.

[2] *Loc. cit.* pl. xlv. figs. 21–23.

The following species have also been founded upon specimens of the fossil dentition, but there are no examples in the Collection :—

Myliobatis altus, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. (1888), p. 40, pl. vii. figs. 1, 2.—Oamaru Formation; New Zealand.

Myliobatis americanus, A. Bravard, Monografia de los terrenos marinos terciarios de los Cercanias del Parana, 1858.

Myliobatis augustus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 325 (name only).—"Eckelsheim, Valley of the Rhine."

Myliobatis apenninus, O. G. Costa, Pal. Regno Napoli, pt. i. (1850), p. 129, pl. vii. fig. 8; A. Issel, Ann. Mus. Civ. Stor. Nat. Genova, vol. x. (1877), p. 339.—Mormanno, S. Italy.

Myliobatis arcuatus, J. W. Davis (*non* Schafhäutl), *loc. cit.* p. 40, pl. vi. figs. 20, 21.—Oamaru Formation; New Zealand.

Myliobatis bellardii, A. Issel, *tom. cit.* p. 331, woodc.—Miocene (? Lower Tongrian); Carcare.

Myliobatis bisulcus, O. C. Marsh, Proc. Amer. Assoc. Adv. Sci. 1869, p. 229.—Eocene Marl; Mammoth Co., New Jersey. [See *M. fastigiatus*.]

Myliobatis bronguiarti, L. Agassiz, *tom. cit.* p. 324 (name only).—Tertiary; Ghent, Belgium.

Myliobatis cuvieri, L. Agassiz, *tom. cit.* p. 325 (name only).—London Clay; Sheppey.

Myliobatis curvipalatus, R. Lydekker, Pal. Ind. ser. 10, vol. iii. (1886), p. 244, pl. xxxv. fig. 9.—Eocene; Kach, India.

Myliobatis dimorphus, E. Delfortrie, Actes Soc. Linn. Bordeaux, vol. xxviii. (1871), p. 227, pl. xi. fig. 39.—Upper Miocene; Léognan, Gironde.

Myliobatis dixmudeu, H. le Hon, Prélim. Mém. Poiss. Tert. Belgique, 1871, p. 13.—Eocene; Belgium.

Myliobatis duplicatus, G. von Munster, Beitr. Petrefakt. pt. vii. (1846), p. 24.—Tertiary; Vienna Basin.

Myliobatis elegans, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. v. (1878), p. 279.—M. Eocene; N. Italy.

Myliobatis curvidens, K. E. Schafhäutl, Süd-Bayerns Leth. Geogn. (1863), p. 238.—U. Eocene; Bavaria.

Myliobatis fastigiatus, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1876, p. 86; also Journ. Acad. Philad. [2] vol. viii. (1877), p. 238, pl. xxxi. fig. 11, pl. xxxiii. fig. 6.—Eocene Marl; Monmouth Co., New Jersey. [This species is founded upon the upper dentition, and Leidy suggests that it may pertain to the species of which Marsh described the lower dentition under the name of *M. bisulcus*.]

Myliobatis funiculatus, E. Delfortrie, *tom. cit.* p. 226, pl. x. fig. 38.—Upper Miocene; Léognan.

Myliobatis gigas, E. D. Cope, Proc. Acad. Nat. Sci. Philad. 1867, p. 140; also J. Leidy, Journ. Acad. Philad. [2] vol. viii. (1877), p. 241, pl. xxxiii. fig. 4. *M. vicomicanus*, E. D. Cope, *tom. cit.* p. 140, and J. Leidy, *tom. cit.* p. 242, pl. xxxiii. fig. 5. As suggested by Leidy, the latter is almost certainly the lower dentition of the former.—Miocene; Charles Co., Maryland, U.S.A.

Myliobatis granulosus, A. Issel, *tom. cit.* p. 335, woodc.—Pliocene; Bacedasco, Parmesan, N. Italy.

Myliobatis guyoti, M. Rouault, Comptes Rendus, vol. xlvii. 1858, p. 101.—Miocene; Rennes, Ille-et-Vilaine, France.

Myliobatis holmesii, R. W. Gibbes, Journ. Acad. Philad. [2] vol. i. (1850), p. 299, pl. xlii. figs. 1–3. *Myliobatis magister*, J. Leidy, Proc. Acad. Philad. 1876, p. 86; and Journ. Acad. Philad. [2] vol. viii. (1877), p. 233, pl. xxxiii. fig. 7.—Ashley River Phosphate Beds, South Carolina.

Myliobatis jugosus, J. Leidy, Proc. Acad. Philad. 1876, p. 86; also Journ. Acad. Philad. [2] vol. viii. (1877), p. 240, pl. xxxi. figs. 4,5.—Marl; Vincenttown, Burlington Co., New Jersey.

Myliobatis lævis, H. von Meyer, Neues Jahrb. 1844, p. 333.—Lower Miocene; Weinheim, Hessen-Darmstadt.

Myliobatis leognanensis, E. Delfortrie, *tom. cit.* p. 228, pl. xi. fig. 40.—Upper Miocene; Léognan.

Myliobatis ligusticus, A. Issel, *tom. cit.* p. 320, woodc.—Lower Pliocene; San Fruttuoso, Valley of Bisagno, N. Italy. [Probably identical with *M. meridionalis*, Gervais.]

Myliobatis meridionalis, P. Gervais, Zool. et Pal. Franç., Poiss. Foss. (1852), p. 15, pl. lxxix. figs. 2–4. *Myliobatis crassus*, P. Gervais, *ibid.* figs. 5, 6.—Pliocene; Montpellier, Languedoc, France. [? Spines figured, *op. cit.* pl. lxxx. figs. 6, 7.]

Myliobatis micropleurus, L. Agassiz, *tom. cit.* p. 318, pl. xlvi. fig. 17. The formation and locality of the type (Faujas Coll., Paris Museum) are unknown, but it was probably derived from the Molasse of Maraval, near Castries, Hérault. From this locality a lower dentition is described and figured by P. Gervais, Zool. et Pal. Franç., Poiss. Foss. (1852), p. 15, pl. lxxx. fig. 4; an upper dentition by P. Gervais, Zool. et Pal. Génér. (1869), pl. xlvii. fig. 10. Another specimen, either of this species or *M. dixoni*, from the Faluns of Mérignac, is described and figured by P. M. Pédroni,

fils, Actes Soc. Linn. Bordeaux, vol. xiii. (1843), p. 291, pl. ii. figs. 1, 2.

Myliobatis microrhizus, E. Delfortrie, *tom. cit.* p. 225, pl. x. fig. 37; A. Issel, *tom. cit.* p. 337.—U. Miocene; Léognan. Also Pliocene, Tuscany (R. Lawley, Nuovi Studi &c. 1876, p. 47).

Myliobatis mordax, J. Leidy, Proc. Acad. Philad. 1876, p. 86; also Journ. Acad. Philad. [2] vol. viii. (1877), p. 234, pl. xxxiii. figs. 1–3.—Ashley-River Phosphate Beds, South Carolina.

Myliobatis ombonii, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. v. (1878), p. 278.—M. Eocene; N. Italy.

Myliobatis pachyodon, E. D. Cope, *tom. cit.* 1867, p. 140; also J. Leidy, Journ. Acad. Philad. [2] vol. viii. (1877), p. 242, pl. xxxii. fig. 6.—Miocene; Charles Co., Maryland. [Doubtfully distinct from *M. gigas*, Cope.]

Myliobatis plicatilis[1], J. W. Davis, *loc. cit.* p. 39, pl. vi. figs. 16–19. —Oamaru Formation; New Zealand.

Myliobatis pressidens, H. von Meyer, Neues Jahrb. 1844, p. 332; also Palæontogr. vol. i. (1848), p. 149, pl. xx. figs. 5, 6. *M. arcuatus*, K. E. Schafhäutl, Süd-Bay. Leth. Geogn. (1863), p. 238, pl. lxii. fig. 14.—U. Eocene; Kressenberg, Bavaria.

Myliobatis regleyi, L. Agassiz, *tom. cit.* p. 320, pl. 46. figs. 6–11. —Eocene; near Brussels, Belgium.

Myliobatis riviereri, H. E. Sauvage, Bull. Soc. Géol. France [3] vol. vi. (1880), p. 623, pl. xi. fig. 3.—U. Eocene; Montmartre.

Myliobatis rugosus, J. Leidy, Proc. Acad. Philad. 1855, p. 395. *Myliobatis obesus*, J. Leidy, ibid. p. 396; also Journ. Acad. Philad. [2] vol. viii. (1877), p. 236, pl. xxxi. figs. 6–10, pl. xxxiv. fig. 44.—Tertiary Greensand; New Jersey.

Myliobatis subalatinus, U. Botti, Atti Soc. Tosc. vol. iii. (1878), p. 371, woodc.—Middle Miocene; Galugnano, S. Donato.

Myliobatis serratus, H. von Meyer, Neues Jahrb. 1843, p. 703. —Lower Miocene; Flonheim, Hessen-Darmstadt. [? Spine figured by K. A. von Zittel, Handb. Paleont. vol. iii. pt. i. 1887, p. 101, woodc. fig. 114.]

Myliobatis serratus, J. Leidy, Proc. Acad. Philad. 1855, p. 395; also Journ. Acad. Philad. [2] vol. viii. (1877), p. 239, pl. xxxii. fig. 5.—Eocene Marl; Burlington Co., New Jersey.

Myliobatis strobeli, A. Issel, *tom. cit.* p. 326, woodc.—Pliocene (?); Mulazzano, N. Tuscany.

[1] To this species probably belong some fragmentary indeterminable teeth from Canterbury, New Zealand (**42020**, *Presented by J. Davies Enys, Esq.*, 1870), and from the Trelissick Beds (**P. 2310**, *By exchange*, 1876).

Myliobatis superbus, M. von Hantken, Mitth. Jahrb. kön. ungar. geol. Anstalt (Pest, 1875), vol. iii. pt. iii. p. 369, pl. xx.—Tertiary; Central Hungary.

Myliobatis testæ, R. A. Philippi, Palæontogr. vol. i. (1846), p. 25, pl. ii. fig. 8; A. Issel, *tom. cit.* p. 333.—Formation and locality doubtful, but probably found with *Carcharodon megalodon* near Ragusa, Sicily.

Myliobatis transversalis, R. W. Gibbes, *tom. cit.* p. 299, pl. lxii. fig. 4.—Buhrstone (Eocene) Formation; Orangeburg, South Carolina.

Some indeterminable much abraded teeth have been referred to "*Myliobatis punctatus*, Agass.," by P. Gervais, Zool. et Pal. Franç., Poiss. Foss. (1852), p. 14, pl. lxxix. fig. 1; A. Issel, *tom. cit.* p. 338; and R. Lawley, Nuovi Studi &c. 1876, p. 48.

A complete fish is known from the Upper Eocene of Monte Bolca, near Verona, having been described by Baron Achille de Zigno under the name of *Myliobatis gazolai*, Mem. R. Istit. Veneto, vol. xxii. (1887), p. 681, pl. v. fig. 1.

The following detached barbed spines have been named, belonging in part to *Myliobatis* and other Myliobatidæ, but perhaps also to unknown Trygonidæ:—

Myliobatis acutus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 331, pl. xlv. figs. 14–17.—London Clay; Isle of Sheppey.

Myliobatis (*Zygobatis*) *acuminatus*, H. von Meyer, Neues Jahrb. 1844, p. 334.—L. Miocene; Weinheim.

Myliobatis canaliculatus, L. Agassiz, *tom. cit.* p. 331, pl. xlv. figs. 18–20; J. Probst, Württ. Jahresh. vol. xxxiii. (1877), p. 90, pl. ii. fig. 2.—London Clay; Sheppey. Molasse, Baltringen (*Probst*).

Myliobatis clavonis, A. de Zigno, Mem. R. Istit. Veneto, vol. xxii. (1887), p. 686, pl. v. fig. 4.—Upper Eocene; Monte Bolca.

Myliobatis faujasii; *Ptychacanthus* (*Ptychopleurus*) *faujasii*, L. Agassiz, *tom. cit.* p. 67 (1838), pl. xlv. figs. 1–3. *Piquant de Pastenaque*, Faujas St. Fond, Ann. Muséum Paris, vol. xiv. (1809), pl. xxiv. figs. 1–3. Also *Myliobatis*, sp., P. Gervais, Zool. et Pal. Franç. Poiss. Foss. (1852), p. 16, pl. lxxx. fig. 5.—Miocene; near Aigues-Mortes, Gard, France.

Myliobatis girondicus, P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. (1843), p. 292, pl. i. figs. 42, 43.—Faluns; Saucats, Gironde.

Myliobatis gracilis, G. von Münster, Beitr. Petrefakt. pt. vii. (1846), p. 25, pl. iii. fig. 4; J. Probst, *tom. cit.* p. 94.—Miocene; Vienna and Baltringen.

Myliobatis haidingeri, G. von Münster, *op. cit.* pt. vii. p. 24, pl. iii. fig. 3; J. Probst, *tom. cit.* p. 93.—Miocene; Vienna and Baltringen.

Myliobatis lateralis, L. Agassiz, *tom. cit.* p. 331, pl. xlv. figs. 24–27. —London Clay; Isle of Sheppey.

Myliobatis leptacanthus, A. de Zigno, *tom. cit.* p. 686, pl. v. fig. 5. —Upper Eocene; Monte Bolca.

Myliobatis marginalis, L. Agassiz, *tom. cit.* p. 331.—Upper Eocene; Barton Cliff.

Myliobatis oweni, L. Agassiz, *tom. cit.* p. 331, pl. xlv. figs. 11–13; F. Dixon, Foss. Suss. pl. x. fig. 10.—Middle Eocene; Bracklesham Bay.

Myliobatis (*Zygobatis*) *rima*, H. von Meyer, Neues Jahrb. 1844, p. 334.—L. Miocene; Weinheim, Hessen-Darmstadt.

Myliobatis (*Zygobatis*) *rugosus*, H. von Meyer, Neues Jahrb. 1844, p. 335.—L. Miocene; Weinheim.

Myliobatis speciosus, G. von Münster, *op. cit.* pt. v. (1842) p. 67. —Miocene; Neudörfl, near Vienna.

Myliobatis sternbergii, L. Agassiz, *tom. cit.* p. 330, pl. xlv. fig. 10.—Valley of Brenta.

Myliobatis toliapicus, L. Agassiz, *tom. cit.* p. 331, pl. xlv. figs. 21–23; F. Dixon, *op. cit.* pl. x. fig. 36. (?) F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 22, pl. ii. fig. 2.—Eocene; S.E. England.

Bates biserratus, J. Probst, Württ. Jahresh. vol. xxxiii. (1877), p. 92, pl. ii. fig. 5.—Molasse; Baltringen, Würtemberg.

Bates flaitanus, J. Probst, *tom. cit.* p. 91, pl. ii. fig. 4.—Molasse; Baltringen.

Bates lineatus, J. Probst, *tom. cit.* p. 90, pl. ii. fig. 3.—Molasse; Baltringen.

Bates spectabilis, J. Probst, *tom. cit.* p. 88, pl. ii. fig. 1.—Molasse; Baltringen.

Vertebræ supposed to be referable to *Myliobatis* are described by C. Hasse (Naturl. Syst. Elasm., Besond. Theil, p. 154), from the Jurassic, Cretaceous, and Tertiary of the Continent.

Genus **RHINOPTERA**, Müller ("æ Kuhl").

[Abh. phys.-math. Cl. k. Akad. Wiss. Berlin, 1834, p. 236.]

Syn. *Zygobates*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 328.

Mylorhina, T. Gill, Ann. Lyc. Nat. Hist. New York, vol. viii. 1867, p. 136.

Micromesus, T. Gill, *tom. cit.* p. 136.

Head free from the disk; so-called cephalic fins paired. Teeth

broad, flat, tessellated, in five or more series, the middle being the largest, the first, or first and second, lateral series on each side somewhat smaller, and the others approximately as broad as long; the dentition of both jaws strongly arched antero-posteriorly. Dental crown smooth or slightly striated; attached surface of tooth longitudinally ridged and grooved. Tail with dorsal fin in front of a barbed spine.

The crowns of the teeth, when unworn, are usually very thick, but, after having been long in function, they become relatively thin. The thickness of the teeth, therefore, sometimes noted in specific descriptions, does not furnish a reliable diagnostic character.

Rhinoptera daviesii, sp. nov.

Type. Portion of dentition (Pl. III. figs. 6, 6 *a*); British Museum.

Teeth transversely channelled, arranged in nine antero-posterior series. Each tooth of the median row is about four times as broad as long; the teeth of the first and second lateral rows are also much transversely elongated, being respectively about three and two-and-a-half times as broad as long; the teeth of the two outer rows are slightly broader than long.

Form. & Loc. London Clay (Lower Eocene): Isle of Sheppey.

P. 1514. Type specimen, generically determined by Mr. William Davies. The fossil consists of a large portion of the dentition with parts of the pterygo-quadrate and mandibular cartilages, embedded in hard clay. The teeth of one jaw are much scattered and displaced, but those of the other are scarcely disturbed, being shown in transverse section surrounding the cartilage, and more than half exposed from above. The upper aspect of the dentition, as far as preserved, is shown of the natural size in Pl. III. fig. 6; the crowns of the teeth have the appearance of being channelled in the direction of their long axes, and they exhibit a curious mode of interlocking antero-posteriorly, well seen in the transverse fracture (Pl. III. fig. 6 *a*). The dental crown is thin and its lower portion is produced into a projecting ridge anteriorly, which fits into a corresponding groove upon the posterior face of the tooth immediately in front, and is firmly held by a small projecting ledge apparently from the root of that tooth. Such an arrangement has already been described by Agassiz in *R. studeri*[1]. The root exhibits the usual antero-posterior grooves and ridges. *Egerton Coll.*

[1] Poiss. Foss. vol. iii. p. 333, pl. R. fig. 4.

Rhinoptera studeri (Agassiz).

1843. *Zygobates studeri*, L. Agassiz, Poiss. Foss. vol. iii. pp. 329, 333, pl. R. figs. 3–5.

1882. *Zygobates studeri*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 57, pl. i. figs. 17, 18.

Type. Detached teeth; British Museum.

A species at present indefinable.

Form. & Loc. Lower Miocene (Molasse): Switzerland, (?) and France.

P. 1523. Two teeth, one apparently median, the other first lateral, bearing Agassiz's MS. label. These must be regarded as the type-specimens of the species; Soleure. *Egerton Coll.*

P. 3062. Two teeth; Soleure. *Enniskillen Coll.*

Rhinoptera woodwardi (Agassiz).

1843. *Zygobates woodwardi*, L. Agassiz, Poiss. Foss. vol. iii. pp. 329, 333, pl. R. figs. 6, 7.

1880. *Rhinoptera woodwardi*, A. Günther, Introd. Study of Fishes, p. 346, woodc. fig. 132.

Type. Detached teeth.

An indefinable species probably of this genus. The restored figure of the dentition given by Dr. Günther is hypothetical.

Form. & Loc. Red Crag and Norwich Crag (Pliocene): Suffolk, Norfolk.

P. 4934. Median (?) dental plate; Red Crag, Suffolk.
Presented by J. E. Lee, Esq., 1885.

P. 1524. Fragments: Norwich Crag, Norwich. *Egerton Coll.*

Detached teeth of *Rhinoptera* have also been described from the Phosphate Beds of South Carolina, under the name of *Zygobatis dubius*, J. Leidy, Proc. Acad. Philad. 1855, p. 396, and Journ. Acad. Philad. [2] vol. viii. (1877), p. 247, pl. xxxi. figs. 21–37.

Vertebræ supposed to be referable to this genus are also described by C. Hasse (Naturl. Syst. Elasm., Besond. Theil, p. 160), from the Upper Cretaceous of Aix and Maastricht, and the Lower Eocene of Brussels.

Genus **AETOBATIS**, Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841 p. 179.]

Syn. *Goniobatis*, Le Hon, Prélim. Mém. Poiss. Tert. Belg. 1871, p. 10

Head free from the disk; so-called cephalic fins paired. Teeth

flat, relatively very broad, in a single antero-posterior series. The upper dentition is strongly arched antero-posteriorly, with the teeth slightly and irregularly curved; the lower dentition is flat, and the teeth are either straight, or more or less angularly bent in the middle. Dental crown smooth or slightly striated; attached surface of root longitudinally ridged and grooved.

In this genus there is much less variability in the relations of the length and breadth of the teeth according to age than in *Myliobatis*; but the form of the lower teeth is so inconstant, that species cannot be determined upon the evidence of the lower dentition alone.

As already recognized by Delfortrie[1], Le Hon's genus *Goniobatis* is founded upon a fragment of the lower dentition of the present form.

Aetobatis irregularis, Agassiz.

1843. *Aetobatis irregularis*, L. Agassiz, Poiss. Foss. vol. iii. p. 327, pl. 47. figs. 3–5.

1850. *Aetobatis irregularis*, F. Dixon, Foss. Suss. p. 200, pl. x. figs. 6–8, pl. xi. figs. 2–4.

1850. *Aetobatis rectus*, F. Dixon, *op. cit.* p. 201, pl. xi. fig. 8.

(?) 1885. *Aetobatis irregularis*, F. Noetling, Abh. Geol. Specialk. Preuss. u. Thüring. Staaten, vol. vi. pt. 3, p. 27, pl. ii. figs. 4, 5.

Type. Fragment of upper dentition; British Museum.

Dental plates of the upper jaw with a relatively low crown, exhibiting scarcely any elevation in the median portion: the anterior and posterior border of each tooth usually more or less irregular, and the extremities gradually curved backwards.

A detached tooth has been described by Dixon as *A. rectus* on account of its being somewhat straighter than the majority referable to this species; but the differences are very slight and appear to be diminished by intermediate specimens, so that we venture to regard it as a variety.

Form. & Loc. London Clay (Lower Eocene): Isle of Sheppey. Bracklesham Beds (Middle Eocene): Bracklesham Bay, Sussex. Barton Clay (Upper Eocene): Barton Cliffs, Hampshire.

P. 3054. Type specimen, figured and described by Agassiz, *loc. cit.*; Isle of Sheppey. *Enniskillen Coll.*

38836. Portion of upper dentition; Isle of Sheppey. *Bowerbank Coll.*

38835. Portions of upper and lower dentition, naturally associated; Isle of Sheppey. *Bowerbank Coll.*

[1] Actes Soc. Linn. Bordeaux, vol. xxviii. 1871, p. 229.

P. 1519. Portion of upper dentition; Bracklesham. *Egerton Coll.*

40524. Rolled fragment of upper dentition; Bracklesham.
Purchased, 1867.

25616. Type specimen of *A. rectus*, Dixon: Bracklesham.
Dixon Coll

P. 5429. Similar specimen; Bracklesham.
Presented by P. E. Coombe, Esq., 1888.

40263. Small upper dental plate: Bracklesham. *Edwards Coll.*

P. 3506. Two detached upper dental plates, and two in natural association; Bracklesham. *Enniskillen Coll.*

P. 1519 a. Fragments of upper dental plates, one perfect, and two in natural association; Bracklesham. *Egerton Coll.*

P. 5588. Connected series of six imperfect upper teeth; Bracklesham. *Harford Coll.*

P. 1517. Upper dental plate and fragment: Barton Cliff.
Egerton Coll.

P. 3055. Portion of lower dentition, showing parts of ten plates; Isle of Sheppey. *Enniskillen Coll.*

25618, 25626. Single dental plate, and series of four, referable to the lower jaw, figured by Dixon as pertaining to the present species, *op. cit.* pl. xi. figs. 3, 4; Bracklesham.
Dixon Coll.

25622. Series of three lower dental plates: Bracklesham.
Dixon Coll.

Aetobatis marginalis, Dixon.

1850. *Aetobatis marginalis*, F. Dixon, Foss. Suss. p. 201, pl. xii. fig. 1.

Type. Portion of upper dentition; British Museum.

The coronal surface is much raised in the middle, thus exhibiting a strongly arched contour, and the tooth attains a considerable thickness. The crown becomes suddenly flattened a short distance from each extremity, producing a small marginal area marked with large longitudinal wrinkles.

Form. & Loc. Bracklesham Beds (Middle Eocene): Bracklesham Bay, Sussex.

25624. Type specimen figured by Dixon, *loc. cit.* *Dixon Coll.*

25625. Fragment of two connected upper dental plates, referred to by Dixon, *loc. cit.* *Dixon Coll.*

P. 5428. Fragments of three teeth.
Presented by P. E. Coombe, Esq., 1888.

Aetobatis, sp. ind.

43317, 44050. Fragments of dental plates; Red Crag, Woodbridge, Suffolk. *Purchased*, 1872, 1873.

The following detached dental plates are referable to the lower jaw of *Aetobatis*, but cannot be specifically determined. They are all from the Middle Eocene of Bracklesham Bay, and most of them probably belong to *A. irregularis*:—

25619, 25629. Gently curved plates, the former described by Dixon (*op. cit.* p. 201, pl. xi. fig. 7) under the name of *A. subarcuatus*, Agass. *Dixon Coll.*

P. 3058. Gently curved plate, of similar type to the preceding. *Enniskillen Coll.*

P. 5430. Two similar specimens. *Presented by P. E. Coombe, Esq.*, 1888.

25617*. Small worn plate, described by Dixon (*op. cit.* p. 200, pl. xi. fig. 6) as type of new species, *A. subconvexus*. *Dixon Coll.*

25627, 25628, 29033. Nine detached plates, and two naturally united, approaching type described by Dixon (*op. cit.* p. 200, pl. xi. fig. 5) as *A. convexus*. *Dixon Coll.*

P. 3057, P. 3060. Five similar detached plates. *Enniskillen Coll.*

P. 1518. Five similar detached plates. *Egerton Coll.*

P. 5431. Four specimens. *Presented by P. E. Coombe, Esq.*, 1888.

The following species have been founded upon detached teeth, but they are mostly undefined, the types being usually fragments of the lower dentition:—

Aetobatis arcuatus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 327.—Molasse; Switzerland. Numerous other Tertiary teeth have been referred to this species by Cope (Proc. Acad. Nat. Sci. Philad. 1867, p. 139), Leidy (Journ. Acad. Nat. Sci. Philad. [2] viii. p. 245, pl. xxxi. figs. 14–18), Gervais (Pal. Franç. pl. 80. figs. 1–3), Delfortrie (Actes Soc. Linn. Bordeaux, vol. xxviii. p. 228, pl. xi. fig. 41), and Probst (Württ. Jahresh. vol. xxxiii. 1877, pl. i. fig. 28).

Aetobatis brevisulcus, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. 1871, p. 13 (name only).—Eocene; Belgium.

Aetobatis giganteus, K. E. Schafhäutl, Süd-Bayerns Leth. Geogn. (1863), p. 237, pl. lxiii. fig. 10.—U. Eocene; Bavaria.

Aetobatis meneghinii, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. v. (1878), p. 278.—Eocene; N. Italy.

Aetobatis omaliusi: *Goniobatis omaliusi*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belgique, 1871, p. 10, woodc.—Pliocene; Belgium.

Aetobatis omaliusi, var. *curtidens*, E. Delfortrie, Actes Soc. Linn. Bordeaux, vol. xxviii. (1871), p. 230, pl. xi. figs. 43–45.—Upper Miocene; Léognan, Gironde.

Aetobatis omaliusi, var. *latidens*, E. Delfortrie, *tom. cit.* p. 229, pl. xi. fig. 42.—Lower Miocene; Taulignan, Drôme.

Aetobatis perspicuus, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1855, p. 396; also Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 244, pl. xxxi. fig. 13.—Eocene (?): Monmouth Co., New Jersey, U. S. A.

Aetobatis profundus, E. D. Cope, Proc. Acad. Philad. 1867, p. 139; J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 246, pl. xxxi. figs. 19, 20.—Phosphate Beds; South Carolina.

Aetobatis sulcatus, L. Agassiz, *tom. cit.* p. 326, pl. xlvi. figs. 4, 5.—Form. and loc. unknown.

Aetobatis turdiveli, M. Rouault, Comptes Rendus, vol. xlvii. (1858), p. 101.—Miocene; Rennes, Ille-et-Vilaine, France.

A dental plate of *Aetobatis* is referred in error to *Myliobatis dixoni* by F. Noetling, Abh. Geol. Specialk. Preuss. etc. vol. vi. pt. 3 (1885), p. 27, pl. ii. fig. 3. Vertebræ from the Samland Eocene are also doubtfully associated with this genus by Noetling, *tom. cit.* p. 29, pl. viii. figs. 3–5.

Vertebræ supposed to be referable to *Aetobatis* are described by C. Hasse (Naturl. Syst. Elasm., Besond. Theil, p. 157), from the Cretaceous and Tertiaries of the Continent.

The genus and species *Mesobatis eximius*, Leidy[1], have been founded upon a portion of the dentition from the Ashley River Phosphate Beds, South Carolina, differing only from *Aetobatis* in the presence of a row of minute lateral teeth, occupying the interspaces of the bevelled ends of the broad teeth.

A dermal tubercle from the Phosphate Beds of South Carolina is assigned to *Ceratopteca* (Müller and Henle) under the name of *C. unios*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 248, pl. xxxiv. figs. 1, 2.

[1] Proc. Acad. Nat. Sci. Philad. 1855, p. 396 (*Aetobatis*); and Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 244, pl. xxxi. fig. 12.

The following extinct genera, being known only by the dentition and vertebræ, are provisionally associated with the family of Myliobatidæ. *Apocopodon* has already been placed here by Cope, and the present writer[1] has suggested that this genus is not improbably a link between the more typical members of the family and the Cretaceous *Ptychodus*.

Genus **APOCOPODON,** Cope.

[Proc. Amer. Phil. Soc. vol. xxiii. 1886, p. 2.]

Median teeth quadrate in form; side teeth with irregularly angulated lateral extremities. Crown elevated, separated from the root by a constriction, the grinding surface covered by a dense layer, with fine antero-posterior wrinkles; attached surface of root with few, very shallow grooves.

Apocopodon sericeus, Cope, *loc. cit.*, is the only known species, from the uppermost Cretaceous of Maria Farinha, Province of Pernambuco, Brazil.

Genus **PTYCHODUS,** Agassiz.

[Poiss. Foss. vol. iii. 1839, p. 150.]

Syn. *Aulodus*, F. Dixon, Foss. Suss. 1850, p. 366.

Teeth quadrate in form, with elevated crown, somewhat overhanging, and sharply separated from the root by a constriction. The crown is enamelled and ornamented with large transverse or radiating ridges, surrounded by a more finely-marked marginal area, of greater or less extent. The surface of attachment of the root is smooth.

Fig. 6.

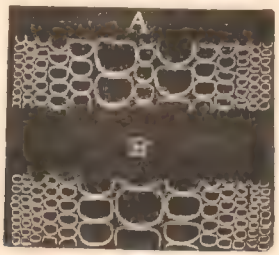


Diagram of arrangement of teeth of *Ptychodus decurrens*[2].
A. Upper jaw. B. Lower jaw.

[1] Proc. Geol. Assoc. vol. x. (1888), p. 297.

[2] Reduced from Proc. Geol. Assoc. vol. x. (1888), p. 296.

In the one jaw, presumably the lower (fig. 6, B), the median series of teeth is the largest, and the lateral rows are arranged symmetrically, diminishing in size to the left and right. In the opposing dentition (fig. 6, A), the median series is very small, and the first lateral row on each side large, with the outer lateral series successively diminishing in size[1].

The vertebræ are very deep compared with their length, complete, and apparently "cyclospondylic" in structure. One example, from the Chalk of Dorking, has been described by C. Hasse[2], under the name of *Selache davisi*.

Ptychodus mammillaris, Agassiz.

1822. Tooth allied to *Diodon*, G. A. Mantell, Foss. South Downs, p. 231, pl. xxxii. figs. 17, 18, 20, 21, 25, 27, 29.
1839. *Ptychodus mammillaris*, L. Agassiz, Poiss. Foss. vol. iii. p. 151, pl. xxv *b*. figs. 12–20 (? fig. 11).
1839. *Ptychodus decurrens*, L. Agassiz, *tom. cit.* p. 154, pl. xxv. *b*. figs. 3, 5.
1839. *Ptychodus altior*, L. Agassiz, *tom. cit.* p. 155, pl. xxv. *b*. figs. 9, 10.
1845. *Ptychodus mammillaris*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 2, pl. ii. figs. 11–13.
1850. *Ptychodus mammillaris*, F. Dixon, Foss. Suss. p. 361, pl. xxx. fig. 6, pl. xxxi. fig. 4.
1850. *Ptychodus mammillaris*, H. B. Geinitz, Charact. böhm.-sächsisch. Kreidegeb. 2nd edit. p. 64, pl. xvii. fig. 7.
1850. *Ptychodus decurrens*, H. B. Geinitz, *op. cit.* p. 64, pl. xvii. figs. 8–12.
1852. *Ptychodus mammillaris*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, vol. xxv. pt. ii. p. 487, pl. xii. fig. 3, pl. xiii. fig. 3.
1854. *Ptychodus mammillaris*, F. J. Pictet, Paléont. 2nd edit. vol. ii. p. 265, pl. xxxviii. fig. 27.
1856. *Ptychodus mammillaris*, C. E. Fischer, Allgem. deutsch. naturh. Zeit. Dresden, n. s. vol. ii. p. 139, pl. ii. fig. 34.
1870. *Ptychodus mammillaris*, F. Roemer, Geol. von Oberschlesien, p. 324, pl. xxxvi. fig. 8.
1872. *Ptychodus mammillaris*, H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. art. 9, p. 16, pl. ii. figs. 86–89.
1875. *Ptychodus mammillaris*, H. B. Geinitz, Palæontogr. vol. xx. pt. i. p. 297, pl. lxiv. fig. 26; pt. ii. p. 213, pl. xl. figs. 23–29.
1878. *Ptychodus mammillaris*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 14, woodc. fig. 33.

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[1] Science Gossip, vol. xxi. (1885), p. 109.

[2] Palæontographica, vol. xxxi. (1884), p. 9, pl. ii. figs. 16, 17

1878. *Ptychodus mammillaris*, St. Zareczuego, Sprawozdanie Komisyi Fizyjograf. Galicyi, vol. xii. p. 201, pl. viii. fig. 9.

1885. *Ptychodus mammillaris*, F. A. Quenstedt, Handb. Petrefakt. 3rd edit. p. 282, pl. xxi. figs. 61, 62.

Type. Detached teeth; British Museum (in part).

The crowns of all the teeth are much elevated, the transversely ridged portion being sharply defined from the surrounding finely-marked area. The latter is relatively extensive, and the delicate rugæ are mostly elongated, and concentric with the borders of the crown: this area is also often marked by radiating grooves.

Form. & Loc. Senonian and Turonian: S.E. England, France, Germany. Turonian and Cenomanian: Belgium, Bohemia, and Russia. Cretaceous: Delaware, U.S.A. (*Agassiz*).

Except where otherwise stated, the following specimens were obtained from undetermined horizons in the Upper or Lower Chalk:—

4402, 4394–6. Four of the type-specimens figured by Agassiz, *tom. cit.* pl. 25 *b*. figs. 12, 14, 15, 18; Lewes, Sussex. *Mantell Coll.*

25775, 28336. Two teeth figured by Dixon, *op. cit.*: Brighton, Sussex. *Dixon Coll.*

28334. Sixteen naturally associated teeth and fragments in block of Sussex Chalk. *Dixon Coll.*

28335. Three large teeth, and four smaller; Brighton. *Dixon Coll.*

4364, 4366–7. Three naturally associated series of teeth, one comprising ten teeth and fragments, the second nine, and the third fourteen; Lewes. *Mantell Coll.*

4397, 4399, 4401, 4404, 4406, 4414, 4426–7, 4430–33, 4435–43, 4447–8, 4450. Twenty-seven detached teeth: Lewes. *Mantell Coll.*

49838–9. Two groups of teeth, perhaps belonging to the same individual; Glynde, near Lewes. *Capron Coll.*

P. 5389. Group of eleven naturally associated teeth, with very broad marginal area, and six similar teeth (including one lower median), probably found with these; Lewes. *Presented by P. E. Coombe, Esq.*, 1888.

P. 5389 a. Another group of eleven teeth; Lewes.
Presented by P. E. Coombe, Esq., 1888.

P. 5390-1. Three large teeth and five small raised teeth; Lewes.
Presented by P. E. Coombe, Esq., 1888.

27032. Series of 23 large teeth, probably found associated; Guildford, Surrey. *Purchased*, 1851.

49840 43. Teeth of large individuals: Upper Chalk, Guildford.
Capron Coll.

47278. Fourteen detached teeth: Dorking. *Purchased*, 1876.

47279. Group of about 37 naturally associated teeth: Lower Chalk, Dorking. *Purchased*, 1876.

39126. Group of about 50 naturally associated teeth; Halling, Kent. *Bowerbank Coll.*

39127. Group of about 36 naturally associated teeth, including one median upper; near Chatham, Kent. *Bowerbank Coll.*

P. 1386–7. Eleven naturally associated teeth in block of Kentish Chalk; and six detached teeth. *Egerton Coll.*

P. 4556. Fine crown of detached lower median tooth: Kent.
Enniskillen Coll.

P. 5332-3. Two much-worn teeth, the second from Rochester, Kent.
Purchased.

43266, 44028. Two detached teeth, one considerably worn; Upper Chalk, Warne's Place, Rochester. *Purchased*, 1871, 1873.

P. 5334. Four associated teeth: Cuxton, Kent. *Purchased.*

47902. Fourteen naturally associated teeth; near Maidstone, Kent.
Presented by the Hon. Robert Marsham, 1877.

35870. Similar tooth: Lower Chalk, Dover, Kent. *Purchased*, 1861.

P. 5204. Block of chalk with seventeen teeth, more or less broken: also three detached teeth; Lower Chalk, Dover.
Purchased, 1886.

P. 1388. Two broken teeth: Lower Chalk, Heytesbury, Wiltshire.
Egerton Coll.

P. 2680, 2680 a, P. 4555. Group of sixteen naturally associated teeth and fragments: another of ten: and two detached teeth; Normandy. *Enniskillen Coll.*

28720. Two teeth; Cenomanian, Tournai, Belgium.
Purchased, 1853.

P. 1390. Six detached teeth from the same formation and locality.
Egerton Coll.

P. 4557. Two teeth; Upper Greensand or Chalk Marl, Montignies, Belgium. *Enniskillen Coll.*

42862. Three small teeth, probably of this species; Roucourt, near Perustetz, Belgium. *Van Breda Coll.*

The following specimens are of a very coarsely marked variety:—

4388 93, 4398, 4400, 4408, 4446. Ten teeth, not improbably found associated; Lewes. *Mantell Coll.*

49732. Portions of block of chalk, with 26 naturally associated teeth; Upper Chalk, Guildford. *Capron Coll.*

49844. Three teeth, found associated; Upper Chalk, Shalford, near Guildford. *Capron Coll.*

35674. Detached tooth; locality unknown. *Bean Coll.*

Ptychodus rugosus, Dixon.

1850. *Ptychodus rugosus*, F. Dixon, Foss. Suss. p. 362, pl. xxxi. fig. 5.
1850. *Ptychodus altior*, F. Dixon (*non* Agassiz), *op. cit.* p. 362, pl. xxx. fig. 10.

Type. Detached tooth.

The crowns of all the teeth are much elevated in the median portion, and marked with coarse rounded ridges. The latter are irregular and considerably interrupted, only about three being usually complete upon the transversely ridged centre. Upon the more finely marked surrounding area the ornament tends towards a concentric arrangement.

In some of the teeth the median portion of the crown is raised into a high, laterally compressed eminence, with smooth sides. Such teeth have been described as referable to a distinct species, *P. altior*, but the examples in the British Museum prove their specific identity with *P. rugosus*. It is also not improbable that the teeth named *P. trigeri* by H. E. Sauvage[1] may belong to this species.

Form. & Loc. Senonian and Turonian: S.E. England.

[1] Biblioth. Ecole Hautes Etudes, vol. v. art. 9 (1872), p. 19; and Bull. Soc. Géol. France, [3] vol. vi. (1880), p. 624, pl. xi. fig. 1. Cenomanian; Dept. Sarthe, France.

39793. Group of about 50 naturally associated teeth, including one from the upper median series ; Upper Chalk, Purley, Kent. *Purchased*, 1866.

32352. Fifteen teeth, probably found associated ; Rochester, Kent. *Purchased*, 1857.

33249. Four teeth, one shown in Pl. V. fig. 1 ; Rochester. *Taylor Coll.*

P. 1377. Seven broken teeth ; Greenhithe, Kent. *Egerton Coll.*

P. 2682–3. Four broken teeth and one much-worn portion of crown ; Greenhithe. *Enniskillen Coll.*

28751. Two fragments of teeth ; Greenhithe. *Presented by the Earl of Enniskillen*, 1853.

32755. One nearly perfect dental crown ; locality unknown. *Purchased*, 1857.

43127. Worn and abraded crown ; Kent. *Wetherell Coll.*

39130. Five associated fragmentary teeth ; near Chatham, Kent. *Bowerbank Coll.*

The following specimens mostly belong to the type figured by Dixon (not by Agassiz) as *P. altior* :—

4421–25, 4428–9. Seven teeth ; Sussex. *Mantell Coll.*

28247. Four teeth ; Upper Chalk, Sussex. *Dixon Coll.*

49851. Two teeth ; Houghton Pit, Arundel, Sussex. *Cupron Coll.*

P. 1380. Eight teeth ; Sussex. *Egerton Coll.*

49849–50. Five teeth ; Upper Chalk, Guildford. *Cupron Coll.*

33250. Group of six naturally associated teeth, including one of the upper median series, shown in Pl. V. fig. 3, and another tooth, shown in Pl. V. fig. 2 ; Kent. *Taylor Coll.*

P. 5335. Four naturally associated teeth ; Kent. *Purchased.*

P. 2679. Three teeth ; Dover, Kent. *Enniskillen Coll.*

Ptychodus oweni, Dixon.

1850. *Ptychodus oweni*, F. Dixon, Foss. Suss. p. 364, pl. xxxi. fig. 2.

Type. Detached tooth; British Museum.

Teeth with rounded, moderately elevated crowns, ornamented with widely separated ridges, which rarely extend directly from side to side, but are disposed in an irregular manner; the marginal finely marked area is insignificant.

This species is very imperfectly known and appears to be rare.

Form. & Loc. Senonian: S.E. England.

39125, 39125 a. Type specimen and four associated teeth; Upper Chalk, Snodland, Kent. One of the teeth, shown in Pl. V. fig. 8, evidently represents the lower median row: a few of the transverse ridges upon the crown are continuous, regular, and parallel in the middle, but those placed posteriorly are very irregular and discontinuous.

Bowerbank Coll.

39700. Abraded and worn tooth, supposed lower median; Kent.

Purchased, 1866.

P. 2688. Similar tooth; Sussex. *Enniskillen Coll.*

28342. Typical tooth; Lewes, Sussex. *Dixon Coll.*

Ptychodus decurrens, Agassiz.

1752. *Dens piscis Ostracionis*, F. E. Brückmann, Acta Phys. Med vol. ix. p. 116, pl. v. fig. 4.

1811. Palate of Unknown Fish, J. Parkinson, Organic Remains, vol. iii. pl. xviii. fig. 12.

1839. *Ptychodus decurrens*, L. Agassiz, Poiss. Foss. vol. iii. p. 154, pl. xxv. *b*. figs. 1, 2, 4, 6–8 (*non* figs. 3, 5).

1840–45. *Ptychodus decurrens*, R. Owen, Odontography, vol. ii. pls. xviii., xix.

1850. *Ptychodus decurrens*, F. Dixon, Foss. Suss. p. 362, pl. xxx. figs. 7, 8, pl. xxxi. fig. 1, pl. xxxii. fig. 5.

1850. *Ptychodus depressus*, F. Dixon, *op. cit.* p. 363, pl. xxxi. fig. 9.

1852. *Ptychodus decurrens*, P. Gervais, Zool. et Pal. Franç. pl. lxxviii. fig. 5.

1852. *Ptychodus decurrens*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, vol. xxv. pt. ii. p. 490, pl. xiii. figs. 4[1], 5.

1852. *Ptychodus decurrens*, F. A. Quenstedt, Handb. Petrefakt. p. 181, pl. xiii. fig. 59.

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[1] The original of this figure is a doubtful tooth subsequently assigned to *P. oweni* (V. Kiprijanoff, *loc. cit.* 1881, pt. ii. p. 2).

1856. *Ptychodus polygyrus*, C. E. Fischer, Allgem. deutsche naturh. Zeit. Dresden, n. s. vol. ii. p. 140, figs. 31–33.

1872. *Ptychodus decurrens*, H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. art. 9, p. 18.

1875. *Ptychodus decurrens*, H. B. Geinitz, Palæontographica, vol. xx. pt. i. p. 296, pl. lxiv. figs. 24, 25.

1878. *Ptychodus latissimus*, St. Zarecznego, Sprawozdanie Komisyi Fizyjograf. Galicyi, vol. xii. p. 200, pl. viii. fig. 8.

1878. *Ptychodus decurrens*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 14, fig. 34.

1882. *Ptychodus decurrens*, F. A. Quenstedt, Handb. Petrefakt. 3rd edit. p. 281, woodc. fig. 86, pl. xxi. figs. 63, 64.

1887. *Ptychodus decurrens*, A. S. Woodward, Quart. Journ. Geol. Soc. vol. xliii. pp. 123–130, pl. x. figs. 1–10, 13.

Type. Detached teeth; one in British Museum.

The median lower teeth are moderately elevated, the coronal contour being greatly arched; and the lateral teeth, both upper and lower, are only slightly raised. The median transverse ridges of each tooth are straight, small, and numerous, and at either extremity pass insensibly into the finely marked marginal area, with little or no terminal reflexion; sometimes those near the anterior border are irregularly branching and broken, and approximate to a diagonal direction.

The arrangement of the complete dentition of this species is known, and two types are distinguishable. In the one described by the present writer, *loc. cit.*, the lower median teeth are remarkably high, and both these and the first lateral series are much transversely elongated. In the second type, made known both by Dixon and the present writer, the lower median teeth are less elevated, and both these and the first lateral series are considerably longer in proportion to their breadth. The latter dentition may belong to a distinct species (*P. depressus*, Dixon), but, upon present evidence, it can only be regarded as a variety.

Form. & Loc. Senonian and Turonian: S.E. England and France. Turonian and Cenomanian: Germany and Bohemia.

Except when otherwise stated, the following specimens were obtained from undetermined horizons in the Upper or Lower Chalk:—

P. 5449. Lower median tooth, figured among the type-specimens of *P. decurrens* by Agassiz, *tom. cit.* pl. xxv. *b.* fig. 8; Lewes, Sussex. *Mantell Coll.*

25773–4, 25776. Three varieties of lower median teeth, figured by Dixon, *op. cit.* pl. xxx. figs. 7, 8, pl. xxxi. fig. 1; Brighton, Sussex. *Dixon Coll.*

28344. A group of eight small lateral teeth, and several detached examples; Brighton. *Dixon Coll.*

49852. Two very small teeth; Dorking, Surrey. *Capron Coll.*

47279. Two lower teeth; Dorking. *Purchased*, 1876.

P. 5851. Median upper, and one other small tooth; Lower Chalk, Guildford, Surrey. *Capron Coll.*

P. 1378. Group of about ninety naturally associated teeth, pertaining to both jaws; Kent. This and the three following specimens comprise teeth agreeing exactly with those of the very complete fossil in the Willett Collection, Brighton, described and figured by the present writer, *loc. cit.* p. 125, pl. x. figs. 4–10. *Egerton Coll.*

P. 2678. Group of about eighty naturally associated teeth of small size; Kent. *Enniskillen Coll.*

P. 379. Group of about forty naturally associated teeth; Kent. *Presented by the Earl of Ducie*, 1881.

33247. Group of seventeen naturally associated teeth; Kent. One of the much-worn lower median teeth is described and figured by the present writer, *loc. cit.* p. 128, pl. x. fig. 13. *Taylor Coll.*

38564–5. Nine teeth of upper jaw in natural position, pertaining to the median and first two lateral rows of the left side, described and figured by the present writer, *loc. cit.* p. 125, pl. x. fig. 3; also three detached teeth from the same jaw; Lower Chalk, Halling, Kent. *Purchased*, 1864.

36636. Thirteen associated lower teeth; Lower Chalk, Halling. *Purchased*, 1862.

30545, 33248, 36637, 43096, 44621. Five lower median teeth from the Chalk of various localities in Kent. *Purchased.*

47903. Seven lower teeth, of large size, pertaining to the median and first lateral series; near Maidstone. *Presented by the Hon. Robert Marsham*, 1877.

32748–9. Seven large lower teeth, pertaining to the median and first lateral series; Lower Chalk, Burham, Kent. One of the median teeth measures 0·065 transversely by 0·045 antero-posteriorly. *Purchased*, 1857.

32748 a, 36638. Five small teeth; Lower Chalk, Burham.
Purchased, 1857, 1862.

P. 1377. Group of eight small lateral teeth; Lower Chalk, Kent.
Egerton Coll.

35883. Lower median tooth, with much elevated crown; Lower Chalk, Dover, Kent. *Purchased*, 1861.

47282, 47284. Nine detached teeth, mostly of the lower jaw, but including one median upper tooth; Lower Chalk, Dover.
Purchased, 1876.

P. 5331. Detached tooth; Cherry Hinton, Cambridgeshire.
Cracherode Bequest.

29041. Three teeth, including one upper median, and one of the upper first lateral series; Whittington, Norfolk.
Presented by C. B. Rose, Esq., 1854.

35020. Large tooth, probably referable to the first lateral row of the upper dentition of *P. decurrens*; Greensand, Regensburg, Bavaria. *Purchased*, 1860.

P. 1379. Large tooth, probably referable to the first lateral row of the lower dentition of *P. decurrens*; Greensand, Lippe, Westphalia. *Egerton Coll.*

The following specimens mostly belong to the depressed variety, with narrow first lateral series of teeth in the lower jaw:—

28348-9. Type specimen of *P. depressus*, Dixon, and a similar tooth; Sussex. *Dixon Coll.*

28343. Eight naturally associated teeth; Lower Chalk, Brighton.
Dixon Coll.

4361. Group of about seventy teeth, naturally associated in block of Chalk; Lewes. *Mantell Coll.*

P. 5393. Two groups of seven and nine teeth respectively; near Lewes. *Presented by P. E. Coombe, Esq.*, 1888.

39436. Group of about 23 teeth, naturally associated with fragments of cartilage and vertebræ, from the Sussex Chalk. The vertebræ are of the same type as the one described by C. Hasse (*loc. cit.*) as *Selache davi[c]si*. *Bowerbank Coll.*

39134. Portion of lower dentition, showing 21 teeth in natural order, described and figured by the present writer, *loc. cit.* p. 124, pl. x. fig. 2; Dorking, Surrey.
Bowerbank Coll.

40056. Group of thirty-four teeth, of which twenty-three are arranged in natural order. The specimen is described and figured by the present writer, *loc. cit.* p. 123, pl. x. fig. 1, and was probably obtained from the Chalk of Maidstone.
Purchased, 1866.

30546. Ten naturally associated teeth, including one lower median and one upper median tooth, probably from the Chalk of Maidstone. *Purchased*, 1856.

30547 8. Twelve teeth not improbably found with the last group.
Purchased, 1856.

39138. Twenty-one naturally associated teeth, two abnormal and much worn, and exhibiting considerable irregularity in the surface-markings; Wouldham, Rochester, Kent.
Bowerbank Coll.

39137. Group of about 45 teeth, naturally associated; Lower Chalk, Halling, Kent. *Bowerbank Coll.*

41241. Twelve teeth, including one lower median, found associated; Lower Chalk, Halling. *Purchased*, 1868.

46962. Nine teeth; Lower Chalk, Burham, Kent.
Purchased, 1876.

47279. Nine teeth, including two lower median; Lower Chalk, Dover. *Purchased*, 1876.

39125. Nine coarsely marked teeth; Upper Chalk, Snodland, Kent.
Bowerbank Coll.

P. 4550. Eleven teeth; Kent. *Enniskillen Coll.*

47904. Four (? lower) teeth; locality unknown.
Presented by the Hon. Robert Marsham, 1877.

39132. Seven teeth; Tring, Herts. *Bowerbank Coll.*

P. 5852. Laterally-worn tooth; Cherry Hinton, Cambridgeshire.
Cracherode Bequest.

28351. Detached tooth; near Cambridge. *Dixon Coll.*

29038. Seven small teeth; Swaffham, Norfolk.
Presented by C. B. Rose, Esq., 1854.

28721. Detached tooth, probably of this species; Upper Greensand, Tournai, Belgium. *Purchased*, 1853.

Ptychodus polygyrus, Agassiz.

1822. Teeth allied to *Diodon*, G. A. Mantell, Foss. South Downs, p. 231, pl. xxxii. figs. 23, 24.
1837. *Ptychodus polygyrus*, W. Buckland, Geol. & Min. 2nd edit. vol. ii. pl. xxvii. *f*.
1839. *Ptychodus polygyrus*, L. Agassiz, Poiss. Foss. vol. iii. p. 156, pl. xxv. figs. 4–11, pl. xxv. *b*. figs. 21–23.
1843. *Ptychodus latissimus*, L. Agassiz, *tom. cit.* p. 157, pl. xxv. *a*. fig. 8.
1850. *Ptychodus polygyrus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 299, pl. xlii. figs. 5, 6.
1850. *Ptychodus polygyrus*, F. Dixon, Foss. Suss. p. 363, pl. xxx. fig. 9, pl. xxxi. fig. 10.
1850. *Ptychodus latissimus*, F. Dixon, *op. cit.* p. xii, pl. xxx. figs. 1, 2.
1852. *Ptychodus polygyrus*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, vol. xxv. pt. ii. p. 494, pl. xiii. fig. 6.
1863. *Ptychodus polygyrus*, S. J. Mackie, Geologist, vol. vi. p. 161, pl. ix.
1868. *Ptychodus polygyrus*, J. Leidy, Proc. Acad. Nat. Sci. Philad. p. 208.
1887. *Ptychodus polygyrus*, A. S. Woodward, Quart. Journ. Geol. Soc. vol. xliii. p. 127, pl. x. fig. 11.

Type. Detached teeth; British Museum (in part).

The median transverse ridges upon the dental crown are relatively large, and curve round more or less at the lateral extremities, being sometimes completely reflexed. The finely marked marginal area is usually of considerable extent and granulated, showing only a tendency towards concentric rugosity immediately adjoining the extremities of the median transverse ridges.

Among the specimens at first referred to this species, Agassiz distinguished four types, which he considered might possibly prove to be specifically distinct. In the absence of more satisfactory materials, however, it is still advisable to retain the original arrangement.

Form. & Loc. Senonian and Turonian: S.E. England, France, Belgium, Russia. Upper Cretaceous: United States, America.

Unless otherwise stated, the following specimens were obtained from undetermined horizons in the Upper or Lower Chalk:—

4385, 4408, 4413. Three of the type specimens figured by Agassiz, *tom. cit.* pl. xxv. figs. 4, 5, 8; Lewes. *Mantell Coll.*

4452. Plaster cast of lower tooth, referred to *P. latissimus* by Agassiz, *tom. cit.* p. 157, pl. xxv. *a*. fig. 8; Sussex (?). *Mantell Coll.*

4387, 4407, 4410-12. Five teeth, the third figured in Mantell's Foss. S. Downs, pl. xxxii. fig. 24; Lewes. *Mantell Coll.*

39123. Lower median tooth, figured in Dixon's Foss. Suss. pl. xxx. fig. 1 (*P. latissimus*). *Bowerbank Coll.*

25771. Tooth of uncertain position, figured by Dixon, *op. cit.* pl. xxx. fig. 2 (*P. latissimus*); Southeram, Sussex. *Dixon Coll.*

25772. Tooth figured by Dixon, *op. cit.* pl. xxx. fig. 9; Lewes. *Dixon Coll.*

25825. Very large lower median tooth; Lewes. *Dixon Coll.*

28338. Nine large teeth; Sussex. *Dixon Coll.*

28337, 28340. Six teeth, naturally associated, and twenty-one others; Lewes. *Dixon Coll.*

P. 5394. Six detached teeth; near Lewes. *Presented by P. E. Coombe, Esq.*, 1888.

P. 2690. One small lower median tooth, and two others; Sussex. *Enniskillen Coll.*

P. 2686. One large lower median tooth, and two other teeth, very flat; Sussex. *Enniskillen Coll.*

P. 5450. Seven naturally associated small teeth; Sussex. *Purchased.*

44171. Tooth in flint; Seaford, Sussex. *Purchased*, 1870.

49845. Detached tooth; Upper Chalk, St. Catherine's Hill, Guildford. *Capron Coll.*

43094. Relatively long tooth, probably lower median, described and figured in the 'Geologist,' vol. vi. p. 161, pl. ix.; Kent. *Wetherell Coll.*

40144. Lower median tooth; Upper Chalk, Charlton, Kent. *Purchased*, 1866.

33251. Similar, but larger, tooth; Kent. *Taylor Coll.*

33231. Large tooth, possibly lower median; Northfleet, Kent. *Purchased*, 1857.

P. 318. Large tooth with narrow peripheral granulated area; Charing, Kent. *Harris Coll.*

47905. Three lower median teeth of medium size, one large worn example, and two lateral teeth; near Maidstone. One of the lower median teeth is shown in Pl. V. fig. 7.
Presented by the Hon. Robert Marsham, 1877.

41240. Much worn tooth, probably lower median; in Chalk Flint, Bromley, Kent. *Purchased*, 1868.

42291. Lower median tooth; Upper Chalk, Rochester, Kent.
Purchased, 1870.

39128. Naturally associated series of nineteen teeth, including one lower median; Kent. *Bowerbank Coll.*

39131. Fourteen naturally associated teeth; Chatham, Kent.
Bowerbank Coll.

33252 a. Sixteen naturally associated teeth; Kent. *Taylor Coll.*

47907. Group of about eighty naturally associated teeth; Lower Chalk, Halling, Kent.
Presented by the Hon. Robert Marsham, 1877.

36747. Group of about fifty similar naturally associated teeth; Lower Chalk, Burham, Kent. *Purchased*, 1862.

44837. Seven naturally associated large teeth, including lower median; near Dover.
Presented by Benjamin Bright, Esq., 1873.

P. 319. Three small teeth, one being upper median and described and figured by the present writer, *loc. cit.* p. 127, pl. x. fig. 11; Lenham, Kent. *Harris Coll.*

P. 5451. Twelve teeth; Lenham.
Presented by John Brown, Esq., 1852.

P. 4549. Three teeth, and one small group; Kent.
Enniskillen Coll.

46391. Two lower median teeth; Winchester, Hants.
Cunnington Coll.

41297a, 47282. Two lower median teeth of small size; English Chalk. *Purchased*, 1869, 1876.

41297–8. Four large teeth; English Chalk. *Purchased*, 1869.

49029. Seven teeth of large individual; Kent. *Mrs. Smith's Coll.*

18777. Four teeth of large individuals; English Chalk.
Presented by Edward Charlesworth, Esq., 1845.

P. 382–4. Three groups of naturally associated teeth, one comprising thirteen, the second six, and the third fourteen; English Chalk. *Presented by the Earl of Ducie*, 1881.

P. 1394. Two teeth; France. *Egerton Coll.*

42861. Large tooth; Antoign, near Tournai, Belgium. *Van Breda Coll.*

P. 4554. Detached tooth; Upper Chalk, Ciply, near Mons, Belgium. *Enniskillen Coll.*

The following teeth are of the flattened variety shown in Agassiz's pl. xxv. figs. 10, 11, and pl. xxv. *b*. fig. 23:—

P. 5395. Detached tooth; near Lewes. *Presented by P. E. Coombe, Esq.*, 1888.

49028. Six naturally associated teeth, cemented by pyrites; Dover. *Mrs. Smith's Coll.*

P. 1393. Four broken teeth; Gravesend, Kent. *Egerton Coll.*

33258. Four similar but smaller teeth; Upper Chalk, Purfleet, Essex. *Taylor Coll.*

P. 380. Five naturally associated teeth; Grays, Essex. *Presented by the Earl of Ducie*, 1881.

33252. Six naturally associated large teeth; Grays. *Taylor Coll.*

P. 4551. Five broken teeth; Normandy. *Enniskillen Coll.*

Ptychodus multistriatus, sp. nov.

Type. Teeth shown in Pl. V. figs. 4–6.

Teeth very similar to those of *P. polygyrus*, but having the transverse ridges upon the crown relatively much more delicate and numerous.

Form. & Loc. Turonian and Senonian: S.E. England.

P. 2681. Group of ten naturally associated teeth of the lower jaw, forming the type-specimen. Pl. V. fig. 4 represents a median tooth inadvertently placed with the anterior border upwards; fig. 5 a first lateral; and fig. 6 an outer series; Kent. *Enniskillen Coll.*

P. 4549 a. Two teeth; Kent. *Enniskillen Coll.*

P. 4558. Crown of lower median tooth; Kent. *Enniskillen Coll.*

P. 1383. Group of seven naturally associated teeth ; Kent.
Egerton Coll.

47281. Two large teeth, probably a variety of this species ; Lower Chalk, Dover. *Gardner Coll.*

47906. Similar lower median tooth ; near Maidstone.
Presented by the Hon. Robert Marsham, 1877.

33253. Almost similar, but broader and more perfect tooth ; Kent.
Taylor Coll.

P. 5605. Three associated teeth and three others ; Burham, Kent.
Harford Coll.

Ptychodus latissimus, Agassiz.

1752. *Dens piscis Ostracionis*, Brückmann, Acta Phys. Med. vol. ix. p. 116, pl. v. fig. 3.
1769. *Zahn eines Seefisches*, C. F. Wilckens, Nachr. Verstein. Thierreiches, p. 81, figs. xlv.–xlvii.
1811. *Fish Palate*, J. Parkinson, Org. Remains, vol. iii. pl. xix. fig. 18.
1822. Tooth allied to *Diodon*, G. A. Mantell, Foss. South Downs, p. 231, pl. xxxii. fig. 19.
1822. *Hinterer kieferzahn einer Rochenart* (?), E. F. von Schlotheim, Petrefakt. Nachtr. i. p. 70, pl. xiii. fig. 2.
1827. *Diodon*, T. A. Catullo, Saggio Zool. Foss. pl. iii. fig. C.
1843. *Ptychodus latissimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 157, pl. xxv. *a*. figs. 1–6 (? fig. 7, *non* fig. 8), pl. xxv *b*. figs. 24–26.
1845. *Ptychodus latissimus*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 1, pl. ii. figs. 5–8.
1845. *Ptychodus decurrens*, A. E. Reuss, *op. cit.* pt. i. p. 1, pl. ii. figs. 9, 10.
1845. *Ptychodus latissimus*, R. Owen, Odontogr. vol. ii. pl. xvii. figs. 1, 2.
1845. *Ptychodus latissimus*, H. B. Geinitz, Versteinerungsk. p. 167, pl. vii. fig. 8.
1850. *Ptychodus latissimus*, H. B. Geinitz, Charact. böhm.-sächsisch. Kreidegeb. 2nd edit. p. 63, pl. vii. fig. 5, pl. xvii. figs. 1–3.
1850. *Ptychodus schlotheimi*, H. B. Geinitz, *op. cit.* p. 63, pl. xvii. figs. 4, 5.
1850. *Ptychodus paucisulcatus*, F. Dixon, Foss. Suss. p. 363, pl. xxx. fig. 3.
1851. *Ptychodus latissimus*, F. Oswald, Zeitschr. deutsch. geol. Ges. vol. iii. p. 531.
1852. *Ptychodus latissimus*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, vol. xxv. pt. ii. p. 483, pl. xii. figs. 1, 2.
1870. *Ptychodus latissimus*, F. Roemer, Geol. Oberschlesien, p. 323, pl. xxxvi. fig. 7.
1873. *Ptychodus latissimus*, F. Stoliczka, Cret. Fauna S. India (Pal. Ind.), vol. iv. pt. iv. p. 66, pl. xii. fig. 16.

1875. *Ptychodus latissimus*, H. B. Geinitz, Palæontogr. vol. xx. pt. ii. p. 212, pl. xl. figs. 16–22.

1878. *Ptychodus latissimus*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 15, woodcut fig. 36.

1887. *Ptychodus paucisulcatus*, A. S. Woodward, Quart. Journ. Geol. Soc. vol. xliii. p. 127, pl. x. fig. 12.

Type. Detached teeth.

Teeth very similar to those of *P. polygyrus*, but having the median transverse coronal ridges of enormous size, never completely reflexed at the extremities.

As proved by a specimen in the Brighton Museum, the lower median tooth of this species is very coarsely marked. The specimen figured by Agassiz, *tom. cit.* pl. xxv. *a*. fig. 8, must thus be regarded as the lower median tooth of *P. polygyrus*.

Form. & Loc. Turonian and Senonian: S.E. England, Germany, Bohemia, and Russia.

Except when otherwise stated, the following specimens were obtained from undetermined horizons in the Upper or Lower Chalk :—

4358. Group of twelve naturally associated teeth, including two of upper median series, one of which is described and figured by the present writer, *loc. cit.*; Lewes.
Mantell Coll.

4355, 4360, 4368. Group of ten naturally associated teeth, including one of lower median series, another of five, another of six teeth, and a smaller group of nine teeth; Lewes.
Mantell Coll.

4369, 4371–2, 4374. Two large and two smaller teeth; Lewes.
Mantell Coll.

P. 5396. Large tooth; near Lewes.
Presented by P. E. Coombe, Esq., 1888.

25826. Type specimen of *Ptychodus paucisulcatus*, Dixon; Sussex.
Dixon Coll.

25826 a, 28335, 28346. Six teeth; Southeram, Sussex.
Dixon Coll.

28341. Group of five small teeth; Lewes. *Dixon Coll.*

28339. Eleven small teeth; Lewes. *Dixon Coll.*

49847. Four fragmentary teeth; Lewes. *Capron Coll.*

P. 1394 a. Lower median tooth; Sussex. *Egerton Coll.*

P. 2684. Coarsely marked large tooth; English Chalk.
Enniskillen Coll.

39129. Very large, nearly perfect tooth; near Croydon, Surrey.
Bowerbank Coll.

P. 5337. Similar tooth; English Chalk. *History unknown.*

P. 385–6. Large tooth, and two groups of three naturally associated small teeth; English Chalk.
Presented by the Earl of Ducie, 1881.

49848. Small tooth; Upper Chalk, Guildford. *Capron Coll.*

47469. Twelve detached side-teeth, probably found associated; near Rochester, Kent. *Purchased*, 1876.

47908. Very coarsely ridged large tooth; near Maidstone, Kent.
Presented by the Hon. Robert Marsham, 1877.

28345. Large tooth; Kent. *Dixon Coll.*

P. 1382. Detached crown of large tooth, and three smaller teeth; Kent. *Egerton Coll.*

37350. Large tooth embedded in flint; Suffolk. *Wetherell Coll.*

P. 5864.. Large lower median tooth; Hertford.

36103. Very large tooth; Orford, Suffolk. *Purchased*, 1861.

P. 5336. Small tooth; Lower Chalk, Heytesbury, Wilts.
Enniskillen Coll.

47498. Plaster cast of specimen figured by Fritsch, *op. cit.*; Lower Chalk, near Koschtitz, Bohemia.
Presented by Prof. Dr. Anton Fritsch, 1876.

28335. Two small teeth, probably pertaining to young of this species; Brighton. *Dixon Coll.*

4373. Small tooth, doubtfully of this species, figured by Mantell, *op. cit.* pl. xxxii. fig. 25; Sussex. *Mantell Coll.*

Ptychodus mortoni, Mantell [1].

1834. *Palate-bones of a fish?*, S. G. Morton, Synopsis Org. Remains Cretaceous U. S. A. pl. xviii. figs. 1, 2.

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[1] This species is recorded as *Platychodus mortoni* in a "Catalogue of Fossils in Lorenzo G. Yates' Collection, Santa Barbara, Cal." (1886), p. 20; but the present writer has failed to discover the authority for the generic name.

1839. *Ptychodus mortoni* (Mantell MS.), S. G. Morton, Journ. Acad. Nat. Sci. Philad. vol. viii. p. 215, pl. xi. fig. 7.
1843. *Ptychodus mortoni*, L. Agassiz, Poiss. Foss. vol. iii. p. 158, pl. xxv. figs. 1–3.
1868. *Ptychodus mortoni*, J. Leidy, Proc. Acad. Nat. Sci. Philad. p. 205.
1887. *Ptychodus mortoni*, A. S. Woodward, Quart. Journ. Geol. Soc. vol. xliii. p. 130.

Type. Detached tooth.

Teeth similar in form to those of the typical species of *Ptychodus*, but differing in having the centre of the crown raised into a sharp point, from which strong branching ridges diverge; the broad marginal area is marked with an almost reticulate ornament.

The tooth from the English Chalk referred to this species by Dixon [1] is at present doubtfully determined.

Form. & Loc. Cretaceous: Alabama, U.S.A.; also Niobrara Cretaceous of Kansas (*Cope*).

28394. Tooth described and figured by Agassiz, *loc. cit.*; Alabama. *Mantell Coll.*

35586–9. Four detached teeth, one being perfect and unworn, the others worn at the apex; Alabama.
Presented by Prof. J. W. Mallet, 1859.

P. 1381. Two detached teeth, one exhibiting perfectly the superficial coronal markings; Alabama. *Egerton Coll.*

P. 2687. Eleven detached teeth. One is of very large size, measuring 0·05 in breadth. Alabama. *Enniskillen Coll.*

Whole or fragmentary teeth of *Ptychodus*, from which the coronal layer of gano-dentine has been broken away by post-mortem abrasion, are sometimes discovered in the Chalk. One of these forms the type of *Aulodus agassizi* [2], and the two following specimens are also figured by Dixon as "Nascent teeth of *Ptychodus*."

28350. Abraded tooth, figured in Dixon's Foss. Suss. pl. xxx. fig. 5; Chalk, Sussex. *Dixon Coll.*

39124. Large abraded tooth, figured *op. cit.* pl. xxx. fig. 4; Chalk, Maidstone. *Bowerbank Coll.*

[1] Foss. Suss. pl. xxxi. figs. 6, 7.
[2] See Proc. Geol. Assoc. vol. x. (1888), p. 298.

In the Collection there are also similar teeth and fragments from Burham (**41697**), Greenhithe (**P. 5452**), Bromley (**41698**), and Dover (**35871**, **35875**, **47285**) in Kent, besides from localities in Sussex (**28389**), and from Warminster, Wilts (**46394**).

The following vertebræ are of the same type as those associated with the group of teeth of *Ptychodus decurrens* referred to above (no. 39436). As already remarked, a similar vertebra has been described in detail by C. Hasse, under the name of *Selache davi[e]si*. The radiating lamellæ are merely represented by faint lines upon the "central double-cone," while the concentric lamellæ are numerous and well developed; these vertebræ thus appear to the present writer to be truly "tectospondylic," and quite comparable with those of *Myliobatis*, only differing from the latter in the presence of small uncalcified areas having the form of an X when viewed in transverse section.

4214–5. Two small series of imperfect vertebræ; Chalk, Sussex. *Mantell Coll.*

P. 4641. Broken specimens in chalk, one partly shown in transverse section, and others in longitudinal section; Sussex. *Enniskillen Coll.*

33295. Large imperfect vertebra; Gravesend, Kent. *Presented by M. Wright, Esq.*, 1858.

49016. Vertebra and fragments; Kent. *Mrs. Smith's Coll.*

40644. Detached specimen much broken, enclosed in flint; Chalk, Norwich. *Presented by W. Firth, Esq.*, 1864.

The following species of *Ptychodus* have also been founded upon detached teeth, but there are no examples in the Collection :—

Ptychodus janevaii: *Sporetodus janevaii*, E. D. Cope, in Hayden's Bull. U. S. Geol. Surv. Territ. no. 2, 1874, p. 47. *P. janewayii*, E. D. Cope, Vert. Cret. Form. West (U. S. Geol. Surv. Territ. 1875), p. 244.—Cretaceous (Niobrara Epoch); Kansas, U.S.A.

Ptychodus occidentalis, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1868, p. 207; also Extinct Vert. Fauna West Territ. (U. S. Geol. Surv. Territ. 1873), p. 298, pl. xvii. figs. 7, 8, pl. xviii. figs. 15–18.—Cretaceous (Niobrara Epoch); Smoky Hill, Kansas, U.S.A.

Ptychodus papillosus, E. D. Cope, Vert. Cret. Form. West (U. S. Geol. Surv. Territ. 1875), p. 294.—Cretaceous; Colorado.

Ptychodus triangularis, A. E. Reuss, Verstein. böhm. Kreideform. 1845, pt. i. p. 2, pl. ii. figs. 14–19. Teeth very doubtfully placed in this genus and referred to *Acrodus* by A. Fritsch, Rept. u. Fische böhm. Kreideform. 1878, p. 16, fig. 38.—Upper Cretaceous; Bohemia.

Ptychodus whippleyi, J. Marcou, Geol. N. America, 1858, p. 33, pl. i. fig. 4; J. Leidy, Extinct Vert. Fauna West Territ. (U. S. Geol. Surv. Territ. 1873), p. 300, pl. xviii. figs. 19, 20; J. S. Newberry, Rep. Expl. Exped. from Santa Fé to Colorado, 1876, p. 137, pl. iii. fig. 2.—Cretaceous (Niobrara Epoch); Colorado, Kansas, New Mexico, U.S.A.

With the Myliobatidæ may also perhaps be associated the small, flattened, rhomboidal teeth from the Upper Chalk of Maastricht, Holland, described under the name of *Rhombodus binkhorsti*, W. Dames, Sitzungsb. Gesell. naturf. Freunde, Berlin, 1881, p. 1, woodcuts.

Family TRYGONIDÆ.

Pectoral fins uninterruptedly continued to, and confluent at, the extremity of the snout. Tail slender, sharply marked off from the disk. Vertical fins absent or imperfectly developed, often replaced by strong serrated spines.

Genus **TRYGON**, Cuvier ("*ex* Adanson").

[Règne Animal, vol. ii. 1817, p. 136.]

Genus **TÆNIURA**, Müller & Henle.

[Syst. Beschreib. Plagiost. 1841, p. 171.]

The known fossil representatives of these two genera have not hitherto been exhaustively studied and described. Prof. Dr. Carl Hasse has made known[1] a detached vertebra, from the Lower Chalk (Aptian) of Dizier, considered to be referable to *Trygon* or an allied genus; R. Lawley[2] has referred a Pliocene dermal tubercle to a species named *T. targionii*; and several nearly complete fishes, probably rightly placed here, have been discovered in the Middle Eocene limestone of Monte Bolca, near Verona. One of the latter

[1] Natürl. Syst. Elasmobr., Besond. Theil, p. 144, pl. xix. figs. 4, 5, 6.

[2] Nuovi Studi Pesci foss. Colline Toscane, 1876, p. 45, pl. ii. fig. 4.

was first figured by Volta[1], under the name of *Raja muricata*, and subsequently assigned to *Trygonobatus vulgaris* by de Blainville[2]. The same specimen was afterwards named by Agassiz[3] *Trygon gazzolæ*; and more recently Molin[4] and Baron de Zigno[5] have founded the genus *Alexandrinum* upon a very similar fossil, which is not clearly distinguished either by the figure or in the descriptions. A second species was described by de Blainville (*loc. cit.*) as *Trygonobatus crassicaudatus*, and likewise re-named by Agassiz (*loc. cit.*) *Trygon oblongus*.

The small fragment of tail, with caudal spine, originally figured upon Volta's plate of "*Raja muricata*," has been identified with other more recently discovered specimens considered by Heckel[6] and Molin[7] to be referable to *Taeniura*, and accordingly named *T. knerii*.

Another Monte Bolca fossil has been described by Molin[8] as referable to *Anacanthus*, Ehrenb. (= *Urogymnus*, Müll. & Henle), and named *A. zigni*. Neither this description, however, nor Baron de Zigno's subsequent figure[9] appears to place the generic determination beyond doubt. There are no dermal asperities such as specially characterize the living *Urogymnus*, and it seems quite possible that the brevity of the tail and the absence of caudal spines may be merely due to accident in preservation.

The New Zealand fossil teeth and spines named *Trygon ensifer*, J. W. Davis (Trans. Roy. Dublin Soc. [2] vol. iv. (1888), p. 37, pl. vi. figs. 13–15), are evidently not Selachian. Equally doubtful also is the so-called *Trygon pastinacoides*, van Beneden (T. C. Winkler, Archiv. Mus. Teyler, vol. iii. 1874, p. 304), from the Bruxellian Eocene of Belgium.

Genus **XIPHOTRYGON**, Cope.

[Amer. Naturalist, vol. xiii. 1879, p. 333.]

Syn. *Heliobatis*, O. C. Marsh, Amer. Journ. Sci. [3] vol. xiv. 1877, p. 256 (undefined).

Distinguished from *Trygon* by the cuspidate character of the teeth.

[1] Ittiolit. Veron. 1796, p. 37, pl. ix. fig. 1.
[2] Nouv. Dict. d'Hist. Nat. vol. xxvii. (1818), p. 336.
[3] Neues Jahrb. 1835, p. 297. Poiss. Foss. vol. iii. p. 382**.
[4] Sitzungsb. math.-nat. Cl. k. Wiss. Wien, vol. xlii. (1861), p. 579.
[5] Mem. R. Istit. Veneto, vol. xviii. (1874), p. 299, pl. xii. (*A. molinii*).
[6] Sitzungsb. math.-nat. Cl. k. Ak. Wiss. Wien, vol. vii. (1851), p. 324.
[7] *Loc. cit.* vol. xlii. (1861), p. 581. [8] *Ibid.* p. 578.
[9] Mem. R. Istit. Veneto, vol. xviii. (1874), p. 298, pl. xi.

Xiphotrygon acutidens, Cope.

1877. *Heliobatis radians,* O. C. Marsh, Amer. Journ. Sci. [3] vol. xiv. p. 256 (undefined).
1879. *Xiphotrygon acutidens,* E. D. Cope, Amer. Nat. p. 333.
1884. *Xiphotrygon acutidens,* E. D. Cope, Vert. Tert. Form. West, Book I. (Rep. U. S. Geol. Surv. Territ. vol. iii.), p. 50, pl. i. figs. 1, 5.

Type. Complete skeleton.

Disk longer than broad, and pectoral fins prolonged anteriorly into a pointed median projection. Caudal spines, triangular in section, three.

Form. & Loc. Middle Eocene (Green River Shales): Twin Creek, S.W. Wyoming, U.S.A.

Genus **UROLOPHUS,** Müller & Henle.

[Syst. Beschreib. Plagiost. 1841, p. 173.]

Tail of moderate length, with a distinct rayed terminal fin and a barbed spine; rudimentary dorsal fin sometimes present. Mouth and dentition as in *Trygon.*

Urolophus princeps, Heckel.

1854. *Urolophus princeps,* J. J. Heckel, Sitzungsb. math.-nat. Cl. k. Ak. Wiss. Wien, vol. xi. p. 124.
1863. *Urolophus princeps,* R. Kner & F. Steindachner, Denkschr. k. Akad. Wiss. Wien, vol. xxi. p. 32, pl. vi. fig. 2.

Type. Complete skeleton; Hof-Museum, Vienna.

Disk broader than long; snout apparently not projecting. Tail shorter than disk; caudal spine extremely large; terminal rayed fin well developed. Skin with small granular calcifications, not spinous.

Form. & Loc. Middle Eocene: Monte Postale, N. Italy.

A vertebra from the Middle Eocene (Bruxellian) of Etterbeck, Belgium, is referred to an undetermined species of *Urolophus* by C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 147, pl. xix. figs. 10–14. Others, from beds of corresponding age in Samland, East Prussia, are described as *Urolophus* (?) *bicuneatus* by F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 34, pl. vii. fig. 8, pl. viii. fig. 11.

Genus **CYCLOBATIS,** Egerton.

[Proc. Geol. Soc. vol. iv. 1844, p. 442.]

Disk circular or oval; tail very short, only slightly projecting, without fins or spine. Rays of paired fins few and well separated; pectorals united in front of the head; pelvics relatively small, and scarcely extending backwards beyond the posterior extremity of the pectorals. Pelvic arch with enormous pre-pubic and iliac processes. Body with one or more median longitudinal series of large spinous tubercles extending from the pectoral arch posteriorly; and the remainder of the trunk and fins more or less sparsely covered with minute prickles. Teeth small, flattened, smooth, either diamond-shaped or discoidal.

Cyclobatis oligodactylus, Egerton.

1844. *Cyclobatis oligodactylus*, Sir P. Egerton, *loc. cit.* p. 442, pl. v.
1850. *Cyclobatis oligodactylus*, F. J. Pictet, Poiss. Foss. M. Liban. p. 55, pl. x. fig. 4.
1887. *Cyclobatis oligodactylus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 491, pl. xxi. fig. 3.
1887. *Cyclobatis oligodactylus*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 508.
1888. *Cyclobatis oligodactylus*, A. S. Woodward, Proc. Zool. Soc. p. 128 (fig. of pelvis).

Type. Nearly complete skeleton; British Museum.

Fin-rays comparatively slender, widely spaced, and not more than 50 in number in the pectorals. Trunk nearly or quite three times as long as broad.

Form. & Loc. U. Cretaceous (Senonian): Hakel and Djebail, Mt. Lebanon.

P. 601. Type specimen, male. From Djebail. *Egerton Coll.*

P. 4009. Complete skeleton, female; from Hakel. The proportions scarcely differ from those of the male, the first being only slightly more elongated. *Purchased*, 1883.

P. 99. Disk, apparently female, wanting parts anterior to mouth; from Hakel. This specimen is referred to by the present writer, *loc. cit.* *Purchased*, 1880.

Cyclobatis major, Davis.

1887. *Cyclobatis major*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 491, pl. xxi. fig. 1.
1887. *Cyclobatis major*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 508.

Type. Nearly complete disk; British Museum.

Fin-rays robust, closely arranged, and more than 50 (usually about 55) in number in the pectorals. Trunk scarcely more than twice as long as broad. Attains to much large dimensions than *C. oligodactylus*.

Form. & Loc. U. Cretaceous (Senonian): Hakel, Mt. Lebanon, Syria.

P. 4011. Type specimen and counterpart. *Purchased*, 1883.

P. 4010. Imperfect disk, smaller than type. *Purchased*, 1883.

P. 100. Complete disk, slightly obscured by matrix. *Purchased*, 1880.

49514. Greater portion of disk and counterpart, showing dermal tubercles; referred to by the present writer, *loc. cit.* *Purchased*, 1878.

49556. Incomplete disk of small individual, probably young of this species. The small dermal tubercles are referred to by the present writer, *loc. cit.* *Purchased*, 1878.

Cyclobatis, sp. ind.

A single specimen (no. **49557**, purchased 1878) not improbably indicates a distinct species from both those already described. The length of the trunk is less than twice its breadth. The number of pectoral fin-rays agrees with that characterizing *C. oligodactylus*, but the fins are relatively broader, and the tail is apparently longer, and armed with series of large spinous tubercles. The specimen is referred to by the present writer, Geol. Mag. [3] vol. iv. 1887, p. 509.

TECTOSPONDYLI INCERTÆ SEDIS.

The two following genera and species are founded upon fragments of pectoral fins, in the Bristol Museum, apparently pertaining to some type of Ray.

Arthropterus vilegi, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 379.—Lias; Bristol.

Cyclarthrus macropterus, L. Agassiz, *tom. cit.* p. 382, pl. xliv. fig. 1. —Lower Lias; Lyme Regis, Dorsetshire.

The teeth described as follows may also pertain to Rays:—

Gryphodobatis uncus, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 249, pl. xxxiv. figs. 8, 9.—Phosphate Beds; South Carolina.

Suborder II. *ASTEROSPONDYLI.*

Vertebræ, when fully developed, having the radiating calcified laminæ predominating over the concentric laminæ (*asterospondylic*, Hasse). Specialization resulting in no marked depression of the body, and the pectoral fins never growing forwards towards the head: spiracles of small size, almost or quite absent in the most specialized forms. Anal fin present.

Division A.—*A single dorsal fin present; gill-clefts more than five in number.*

The following primitive family is provisionally placed here, its distinctive subordinal characters being not yet very evident, but its relationships being obviously closer with the Cestraciontidæ than with any other hitherto recognized family.

Family NOTIDANIDÆ.

Single dorsal fin, without spine, remote; caudal fin large. No nictitating membrane; gill-clefts 6–7; spiracles small. Teeth with sharply-pointed coronal cusps, several series simultaneously functional.

Genus **NOTIDANUS,** Cuvier.

[Règne Animal, vol. ii. 1817, p. 128.]

Syn. *Heptranchias*, C. S. Rafinesque Schmalz, Caratt. Nuovi Gen. Anim. Sicilia, 1810, p. 13.
Hexanchus, C. S. Rafinesque Schmalz, *op. cit.* p. 14.
Monopterhinus, H. D. de Blainville, Bull. Soc. Philom. 1816, p. 121 (in part).
Aellopos, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 376 (in part).
Xiphodolamia, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. 1877, p. 252.

Body moderately elongated: mouth inferior: gill-openings six or seven, without flaps of skin. Principal teeth consisting of a series of compressed cusps fixed upon a long base; all the cusps inclined in one direction, the anterior larger than the others, with or without small denticles at its base in front. Anterior teeth of the upper jaw clustered, awl-shaped; a median symphysial series in

the lower jaw. Principal teeth of the upper jaw less laterally elongated, with fewer cusps than those of the lower jaw. Notochord persistent, except occasionally in the caudal region [1].

Notidanus muensteri, Agassiz.

1843. *Notidanus muensteri*, L. Agassiz, Poiss. Foss. vol. iii. p. 222, pl. xxvii. figs. 2, 3.
1849. *Notidanus muensteri*, Beyrich & Frischmann, Zeitschr. deutsch. geol. Ges. vol. i. p. 436, pl. vi.
1852. *Notidanus muensteri*, F. A. Quenstedt, Handb. Petrefakt. p. 167, pl. xiii. fig. 4.
1858. *Notidanus muensteri*, F. A. Quenstedt, Der Jura, p. 783, pl. xcvi. figs. 33, 34.
1861. *Notidanus eximius*, A. Wagner, Abh. k. bay. Akad. Wiss. cl. ix. vol. ix. p. 292, pl. iv. fig. 2.
1875. *Notidanus eximius*, K. Fricke, Palæontogr. vol. xxii. p. 394, pl. xxi. fig. 22.
1882. *Notidanus* (*Heptanchus*) *eximius*, C. Hasse, Natürl. Syst. Elasm., Besond. Theil, p. 51, pl. vii. figs. 21–25.
1886. *Notidanus eximius*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 209, pl. vi. figs. 3–5.
1887. *Notidanus muensteri*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 66.

Type. Detached tooth.

A species attaining a maximum length of not less than 2·8 metres; snout rounded and obtuse; anal fin smaller than the dorsal, probably not at all opposite the latter. Vertebral column as in the existing subgenus *Heptanchus* (according to Hasse). Principal cone in the lateral teeth relatively large and broad, without anterior denticles, and followed by not more than three or four secondary cones.

A nearly complete fish in the Munich Museum is made known by Beyrich and Frischmann and by Wagner; but the supposed young individuals referred to by the latter do not belong to the family of Notidanidæ (see *Pristiurus*).

Form. & Loc. Oxfordian: Bavaria and Switzerland. Corallian: Würtemberg and Hanover. Lower Kimmeridgian: Bavaria and Würtemberg.

22500, 35763, 35763 a. Three teeth, described and figured by the present writer, *loc. cit.* p. 210, pl. vi. figs. 3–5; Corallian, Schnaitheim, Würtemberg. *Purchased*, 1848, 1860.

22489–91, 35764. Seven imperfect teeth; Schnaitheim. *Purchased*, 1848, 1860.

[1] A. Kölliker (Verh. phys.-med. Gesell. Würzburg, vol. x. 1860, p. 198, pl. ii. fig. 3) notes the presence of calcified caudal vertebræ in *Heptanchus*, feebly asterospondylic in structure.

P. 4708. Tooth exhibiting abraded apex of principal cone, noticed by the present writer, *loc. cit.* p. 210; Schnaitheim.
Enniskillen Coll.

P. 4709. Imperfect tooth; Schnaitheim. *Enniskillen Coll.*

22502. Upper tooth, doubtfully referred to this species, figured, *loc. cit.* pl. vi. fig. 6; Schnaitheim. *Purchased*, 1848.

Notidanus serratus, Fraas.

1855. *Notidanus serratus*, O. Fraas, Württ. Jahresh. vol. xi. p. 98.
1858. *Notidanus serratus*, F. A. Quenstedt, Der Jura, p. 784, pl. xcvi. fig. 44.
1886. *Notidanus serratus* (?), A. S. Woodward, Geol. Mag. [3] vol. iii. p. 212, pl. vi. fig. 7.

Type. Group of twelve teeth; Tübingen Museum.

Principal cone of lower lateral teeth relatively large, strongly serrated anteriorly; posterior secondary cones often as many as seven in number, the first two much larger than the others. Base of teeth depressed.

Form. & Loc. Corallian: Würtemberg. Oxfordian: Yorkshire.

35667. Upper tooth, from the Oxford Clay of Scarborough, Yorkshire, doubtfully assigned to this species by the present writer, *loc. cit.* A subsequent examination of the type specimen in Tübingen has confirmed the determination.
Purchased, 1859.

Notidanus dentatus, A. S. Woodward.

1886. *Notidanus dentatus*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 214, pl. vi. figs. 17, 18.
1888. *Notidanus dentatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 36, pl. vi. figs. 9–12.

Type. Upper and lower teeth; British Museum.

Principal cone of lower lateral teeth relatively small; secondary cones three or four in number; anterior denticulations of very large size.

Form. & Loc. "Lower Greensand": Amuri Bluff, New Zealand.

P. 2303, P. 2303 a. Type specimens. *By exchange*, 1876.

Notidanus lanceolatus, A. S. Woodward.

1886. *Notidanus lanceolatus*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 214, pl. vi. fig. 16.

Type. Detached tooth; British Museum.

An imperfectly defined species, founded apparently upon an upper tooth, remarkable for the length and slenderness of the coronal cones, which are few in number; the two anterior denticles are of large size.

Form. & Loc. Gault: (?) Folkestone.

P. 1227. Type specimen. *Egerton Coll.*

Notidanus microdon, Agassiz.

1822. Tooth of *Squalus?*, G. A. Mantell, Foss. South Downs, p. 227, pl. xxxii. fig. 22.

1843. *Notidanus microdon*, L. Agassiz, Poiss. Foss. vol. iii. p. 221, pl. xxvii. fig. 1, pl. xxxvi. figs. 1, 2.

(?) 1843. *Notidanus pectinatus*, L. Agassiz, *tom. cit.* p. 221, pl. xxxvi. fig. 3.

1846. *Notidanus microdon*, A. E. Reuss, Verstein. böhm. Kreideform. pt. ii. p. 98, pl. xlii. fig. 8.

1850. *Notidanus microdon*, H. B. Geinitz, Charact. Schicht. u. Petrefakt. sächs.-böhm. Kreidegeb. 2nd. edit. p. 38, pl. ix. fig. 2.

1850. *Notidanus microdon*, F. Dixon, Foss. Sussex, pl. xxx. fig. 30.

1875. *Notidanus microdon*, H. B. Geinitz, Palæontogr. vol. xx. pt. ii. p. 210, pl. xl. fig. 1.

1878. *Notidanus microdon*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 12, woodc. fig. 25.

1886. *Notidanus microdon*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 213, pl. vi. figs. 10–15.

1888. *Notidanus microdon*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 287.

Type. Detached tooth.

Principal cone of lower lateral teeth relatively large, sometimes slender and acutely pointed; secondary cones not more than seven in number; anterior denticulations numerous and fine, but well-marked.

The teeth commonly referred to this species exhibit considerable variations, but none of the observed differences can at present be regarded as of specific value. A series from the English Chalk is described and figured by the present writer, *loc. cit.*

Form. & Loc. Cambridge Greensand: Cambridge. Chalk: Bohemia, Germany, and S.E. England.

4164, 4167–8. Four teeth; Lewes, Sussex. One is figured by Mantell, *loc. cit.*, and another by the present writer, *loc. cit.* pl. vi. fig. 11. *Mantell Coll.*

25793–4. Six teeth; Sussex. *Dixon Coll.*

49936. Three teeth; Brighton, Sussex. *Capron Coll.*

49938. Tooth; Newtimber, Sussex. *Capron Coll.*

49937. Tooth; Guildford, Surrey. *Capron Coll.*

32342, 33175. Two teeth, one showing a very deep root; Lower Chalk, Burham, Kent. *Purchased*, 1857.

46960. Tooth; Lower Chalk, Burham. *Purchased*, 1876.

47918. Eight teeth; near Maidstone.
Presented by the Hon. Robert Marsham, 1877.

P. 320. Three teeth; Charing, Kent. *Harris Coll.*

41706. Two teeth; Kent. *Toulmin Smith Coll.*

44214, 47292. Three teeth; Kent. *Purchased*, 1873, 1876.

44580. Tooth, figured by the present writer, *loc. cit.* pl. vi. fig. 12; Kent. *Purchased*, 1873.

P. 4569. Four teeth; Kent. *Enniskillen Coll.*

29039. Four teeth; Swaffham, Norfolk.
Presented by C. B. Rose, Esq., 1854.

24927–8. Three teeth and one fragment; Upper Chalk, Norwich. One specimen is an anterior upper tooth, figured by the present writer, *loc. cit.* pl. vi. fig. 10; another is either a lower or upper lateral tooth, figured *loc. cit.* fig. 13.
Purchased, 1850.

35648. Three teeth; Upper Chalk, Norwich. One is figured, *loc. cit.* pl. vi. fig. 14. *Bayfield Coll.*

48950. Three teeth; Upper Chalk, Norwich. One is figured, *loc. cit.* pl. vi. fig. 15. *Bayfield Coll.*

P. 399. Tooth in Chalk from uncertain locality.
Presented by the Earl of Ducie, 1881.

P. 5596. Seven teeth; Chalk, Kent. *Harford Coll.*

36595-6. Eleven more or less fragmentary teeth: Cambridge Greensand, Cambridge. *Purchased*, 1862.

46363. Three teeth, probably of upper jaw; Cambridge Greensand. *Cunnington Coll.*

P. 5369. Twenty more or less fragmentary teeth; Cambridge Greensand. *Presented by James Carter, Esq.*, 1887.

Notidanus serratissimus, Agassiz.

1776. *Dens Squali*, G. Brander, Fossilia Hantoniensia, fig. 111.
1843. *Notidanus serratissimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 222, pl. xxxvi. figs. 4, 5.
1883. *Notidanus serratissimus*, H. B. Geinitz, Abh. naturw. Ges. Isis Dresden, p. 108, woodcut.
1886. *Notidanus serratissimus*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 216, pl. vi. figs. 23–26.

Type. Detached teeth.

Principal cone of lower lateral teeth relatively large, with numerous strong anterior serrations, diminishing in size downwards; secondary cones sometimes as many as eight in number.

The specimens in the collection might, at first sight, be regarded as pertaining to two distinct species, the small teeth described and figured by the present writer, *loc. cit.* p. 216, pl. vi. figs. 24–26, being very different in character from the type-specimens made known by Agassiz. A fossil in the Museum of Practical Geology, however, shows that the former are immature teeth, evidently referable to a lateral position in the lower jaw of this species. The teeth first described were thus probably situated in the upper jaw.

A tooth from the Lower Miocene of Zabrze, Silesia, described by F. Roemer[1], may belong either to this species or to *N. primigenius*. Some teeth from the Pliocene of Tuscany[2] are also very similar to the type specimens of *N. serratissimus*, and these are associated with small lower teeth (so-called *N. targionii*) closely resembling those alluded to above.

Form. & Loc. Lower Eocene (London Clay): London Basin. Upper Eocene: Helmstedt, Brunswick.

24618. Nine teeth of the typical form: Isle of Sheppey. One is figured by the present writer, *loc. cit.* pl. vi. fig. 23. *Purchased*, 1850.

[1] Geol. von Oberschlesien, 1870, p. 379, pl. xlviii. fig. 1.
[2] *N. microdon*, R. Lawley, Atti Soc. Tosc. vol. iii. 1877, p. 70, pl. ii. fig. 2.

28890, 30550, 32265. Six similar teeth, and one smaller; Isle of Sheppey. *Purchased.*

38866. One perfect and one imperfect tooth; Isle of Sheppey. *Bowerbank Coll.*

P. 440. Two similar teeth; Isle of Sheppey. *Purchased*, 1882.

28890 a, 28890 b, 30550 a, 38866 a. Small lower lateral teeth; Isle of Sheppey. The first and third are described and figured by the present writer, *loc. cit.* p. 213, pl. vi. figs. 24, 25; the delicacy of the anterior serrations is a character of immaturity. *Purchased.*

43133. Immature lower tooth and fragment, the first described and figured by the present writer, *loc. cit.* p. 216, pl. vi. fig. 26; Highgate. *Wetherell Coll.*

43142. Small tooth, of typical form; Kensal Green. *Wetherell Coll.*

To the front of the upper jaw either of this species or *N. primigenius* may also probably be referred the following specimens:—

43141. Three teeth, one being much abraded, of the form named *Xiphodolamia* by J. Leidy; London Clay, Sheppey.

Notidanus primigenius, Agassiz.

1843. *Notidanus primigenius*, L. Agassiz, Poiss. Foss. vol. iii. p. 218, pl. xxvii. figs. 6–8, 13–17 (? figs. 4, 5).
1843. *Notidanus recurvus*, L. Agassiz, *tom. cit.* p. 220, pl. xxvii. figs. 9–12.
1843. *Sphyrna denticulata*, L. Agassiz, *tom. cit.* p. 236, pl. xxvi. *a*. figs. 60, 61.
1844. *Notidanus primigenius*, P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. p. 281, pl. i. figs. 10, 11.
(?) 1849. *Notidanus primigenius*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 195, pl. xxv. fig. 95.
1852. *Notidanus primigenius*, P. Gervais, Zool. et Pal. Franç., Poiss. p. 10, pl. lxxiv. figs. 9, 10.
1852. *Notidanus primigenius*, F. A. Quenstedt, Handb. Petrefakt. p. 167, pl. xiii. fig. 3.
1858. *Notidanus primigenius*, J. Probst, Württ. Jahresh. vol. xiv. p. 124, woodc.
1863. *Notidanus primigenius*, K. E. Schafhäutl, Süd-Bayerns Leth. Geogn. p. 239.
1879. *Notidanus primigenius*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 66.

1879. *Notidanus recurvus*, J. Probst, Württ. Jahresh. vol. xxxv. p. 162, pl. iii. figs. 12–17.

1879. *Notidanus primigenius*, J. Probst, *tom. cit.* p. 158, pl. iii. figs. 1–5.

1879. *Notidanus d'anconæ*, J. Probst, *tom. cit.* p. 166, pl. iii. figs. 6–11.

(?) 1880. *Notidanus microdon*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. i. p. 6, pl. i. figs. 15, 16.

1885. *Notidanus primigenius*, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3, p. 17, pl. i. figs. 4, 5.

1886. *Notidanus primigenius*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 216, pl. vi. figs. 19, 20, 22 (? fig. 21).

Type. Detached teeth; Munich Museum.

The limits of this species are at present unsatisfactorily defined. The teeth appear to pass, on the one hand, into those of *N. serratissimus*, from most of which they can only be distinguished by their larger size; and, on the other, they are indefinitely separated from the teeth of *N. gigas*, the lateral mandibular examples of which are longer and generally possess a greater number of secondary cones. The statement of Agassiz, repeated by the present writer, that the teeth of *N. primigenius* differ from those of *N. serratissimus* in the more acute character of the cones, and the less uniform size of the anterior serrations, is shown to be inaccurate by a study of the variations in a larger series of specimens; though the features just mentioned are often distinctive. A specific character is also found in the lower median tooth, which almost certainly has a well-defined median cusp.

It is probable that the originals of Agassiz's figs. 4, 5 do not pertain to the same species as those of figs. 6–8, 13–17, which are regarded as the typical teeth; but *N. recurvus* may be referred, with much probability of correctness, to the upper jaw of *N. primigenius*. The localities of most of the type specimens are unknown, but they were probably all obtained from the Molasse; and it seems advisable at present to restrict the name to teeth from the Upper Eocene and Miocene, no undoubted specimens being known from the Pliocene.

Form. & Loc. Upper Eocene: S. England and N. Germany. Lower Miocene: Belgium, Hessen-Darmstadt, Würtemberg, and Switzerland[1].

P. 1224. Two fine teeth; Upper Eocene, Barton Cliff, Hampshire. One is figured by the present writer, *loc. cit.* pl. vi. fig. 22. *Egerton Coll.*

P. 5802. Similar tooth; Barton Cliff. *Enniskillen Coll.*

[1] A very doubtful tooth from the Molasse of Montpellier, S. France, is also referred to *N. primigenius* by P. Gervais, Pal. Gén. p. 239, fig. 36 (woodc.).

P. 4707. Upper anterior tooth, figured by the present writer, *loc. cit.* pl. vi. fig. 19; Upper Eocene, Hampshire.
Enniskillen Coll.

35541. One perfect tooth, and two fragments: Rupelian Beds, Klein Spauwen, Belgium. *Purchased*, 1859.

P. 1226. Portion of tooth; Rupelian Beds, Boom, near Antwerp.
Egerton Coll.

35533–34. One anterior upper tooth, figured by the present writer, *loc. cit.* pl. vi. fig. 20, and portions of seven other teeth; Molasse, Baltringen, Würtemberg. *Purchased*, 1859.

35535. Imperfect tooth: Molasse, Canton Aargau, Switzerland.
Purchased, 1859.

P. 1225. Tooth; Molasse, Switzerland. *Egerton Coll.*

P. 5551. Six teeth; Miocene, Weinheim, Hessen-Darmstadt.
By exchange, 1888.

P. 441. Typical tooth; locality unknown. *Purchased*, 1882.

P. 5803. Tooth with very large anterior denticulations, doubtfully referred to this species; Molasse, North Germany.

Notidanus gigas, Sismonda[1].

1857. *Notidanus gigas*, E. Sismonda, Mem. R. Accad. Sci. Torino [2] vol. xix. p. 460, fig. 13.
1877. *Notidanus gigas*, R. Lawley, Atti Soc. Tosc. vol. iii. p. 68, pl. i. fig. 6.
1877. *Notidanus meneghinii*, R. Lawley, *tom. cit.* p. 72, pl. ii. fig. 4.
1886. *Notidanus meneghinii*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 255, woodcut fig. 2.
1886. *Notidanus gigas*, A. S. Woodward, *tom. cit.* p. 255, woodcut fig. 1.
1886. *Notidanus gigas*, H. M. Platnauer, Ann. Rep. Yorks. Phil. Soc. pl. i. fig. 4.
1886. *Notidanus meneghinii*, H. M. Platnauer, *loc. cit.* pl. i. fig. 5.

Type. Detached lower tooth.

A somewhat larger species than *N. primigenius*. Lower lateral teeth differing from the typical teeth of the latter in the larger

[1] Several teeth, perhaps referable to this species, are figured by A. Scilla, 'De corporibus marinis' (1752), pl. i. figs. 1–8.

number of the cones, and the relatively greater extent of the anterior serrated margin; the crown beneath and in advance of the principal cone is produced far down upon the root. As suggested by Probst, it is not impossible that the lower median tooth referred by Lawley[1] to *N. primigenius* may belong to this species: it has no definite median cone. The anterior upper teeth from the Pliocene of Tuscany described by Lawley[2] as *N. primigenius* and *N. recurvus* are also probably referable to *N. gigas*.

Fig. 7.

Teeth of *Notidanus gigas*. Red Crag, Suffolk.

N. meneghinii appears to be founded upon the less abraded teeth of this species.

Form. & Loc. Pliocene: N. Italy and S.E. England.

47019. Portions of two large teeth; Orciano, Tuscany.
Purchased, 1875.

P. 5804. Worn fragment; Red Crag, Felixstowe, Suffolk.
Brown Coll. Presented by Prof. Sir Richard Owen, K.C.B., 1859.

P. 5574. Complete tooth with eleven cones; Red Crag, Felixstowe.
Harford Coll.

P. 5575. Imperfect tooth; Red Crag, Orford Castle. *Harford Coll.*

P. 5576. Two smaller teeth, doubtfully assigned to this species; Red Crag, Suffolk. *Harford Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection :—

Notidanus anomalus, R. Lawley, Atti Soc. Tosc. vol. iii. (1877), p. 74, pl. iii. fig. 5; A. S. Woodward, Geol. Mag. [3] vol. iii. p. 256.—Pliocene; Tuscany.

Notidanus aptiensis, F. J. Pictet, Ann. Soc. Lit. Sci. et Art. Apt.

[1] Atti Soc. Tosc. vol. iii. pl. i. fig. 4.
[2] *Tom. cit.* pp. 66, 69, pl. i. figs. 2, 3, 5, pl. ii. fig. 1.

vol. i. (1865), p. 67: E. Arnaud, Bull. Soc. Géol. France [3], vol. x. (1882), p. 132.—Lower Cretaceous; Apt, Vaucluse, France.

Notidanus contrarius, G. von Münster, Beitr Petrefakt. vi. (1843), p. 54, pl. ii. fig. 3.—Lower Oxfordian; Bavaria.

Notidanus d'ancona, R. Lawley, *loc. cit.* vol. iii. (1877), p. 73, pl. iii. figs. 1, 2; *non* J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 166, pl. iii. figs. 6–11.—Pliocene; Tuscany.

Notidanus daviesii, A. S. Woodward, Geol. Mag. [3] vol. iii. (1886) p. 212, pl. vi. fig. 8: *Hybodus polyprion*, J. Phillips (*non* Agassiz), Geol. Oxford (1871), p. 305, pl. xii. fig. 18.—Oxford Clay; Oxford.

Notidanus delfortriei, R. Lawley, *loc. cit.* vol. iv. (1879), p. 197.—Pliocene; Tuscany. [Lower median tooth.]

Notidanus hugelii, G. von Münster, *op. cit.* vi. (1843), p. 54, pl. i. fig. 5; (?) F. A. Quenstedt, Handb. Petrefakt. (1852), p. 167, pl. xiii. figs 5, 6, and Jura (1858), p. 519; A. S. Woodward, Geol. Mag. [3] vol. iii. p. 211.—Corallian; Würtemberg.

Notidanus intermedius, A. Wagner, Abh. k.-bay. Akad. Wiss. math.-phys. Cl. vol. ix. (1861), p. 299, pl. iv. fig. 3.—Lower Kimmeridgian (Lithographic Stone); Solenhofen, Bavaria.

Notidanus loozi, G. Vincent, Ann. Soc. Roy. Malacol. Belg. vol. xi. (1876), p. 126, pl. vi. fig. 5.—Lower Landenian; Belgium.

Notidanus marginalis, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. (1888), p. 34, pl. vi. fig. 8 (*non* fig. 7).—Oamaru and Waipara Formations; New Zealand. [The supposed upper tooth of this species is referable to *Galeocerdo*.]

Notidanus nettelbladti, T. C. Winkler, Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. (1875), p. 111, pl. ii. fig. 5.—Miocene; Sternberg.

Notidanus plectrodon, E. D. Cope, Proc. Acad. Nat. Sci. Philad. 1867, p. 141.—Miocene; United States.

Notidanus problematicus, R. Lawley, *loc. cit.* vol. iii. (1877), p. 74, pl. iii. figs. 3, 4.—Pliocene; Tuscany.

Notidanus repens, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 163, pl. iii. fig. 18 (? 19–22); A. S. Woodward, Geol. Mag. [3] vol. iii. p. 254.—Miocene; Würtemberg.

Notidanus stoppani, R. Lawley, *loc. cit.* vol. iv. (1879), p. 199.—Pliocene; Tuscany. [Lower median tooth.]

Notidanus targionii, R. Lawley, *loc. cit.* vol. iii. (1877), p. 71, pl. ii. fig. 3.—Pliocene; Tuscany.

Notidanus thevenardi, E. Delfortrie, Actes Soc. Linn. Bordeaux, vol. xxxii. (1878), p. 256, woodcuts.—Faluns; St. Médard, Gironde, France. [Lower median tooth.]

Notidanus urcianensis, R. Lawley, *loc. cit.* vol. iv. (1879), p. 198. —Pliocene; Tuscany. [Lower median tooth.]

Of the above species, those founded upon lower median teeth are especially doubtful. The so-called *Notidanus amalthei*, Oppel[1], from the Lias of Würtemberg and Yorkshire, has been recorded upon the evidence of indeterminable fragments; and the present writer has been unable to confirm Münster's determination[2] of a tooth of this genus from the same horizon. A tooth from the Oxfordian of Switzerland ascribed to *Notidanus* by E. Favre[3] appears also to be doubtfully determined, and most likely pertains to *Hybodus*.

The caudal region of a Selachian from the Lithographic Stone of Bavaria, named *Aellopos wagneri* by Agassiz (Poiss. Foss. vol. iii. 1843, p. 377), is also referred to *Notidanus* by A. Wagner, Abh. k.-bay. Akad. Wiss. math.-phys. Cl. vol. ix. p. 296. A nearly complete fish, from the Upper Cretaceous of Mount Lebanon, is also described under the name of *N. gracilis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 470, pl. xiv. fig. 1. The former specimen is preserved in the Munich Museum, the latter at Edinburgh.

Notidanus biserratus, Münster (Beitr. Petrefakt. v. 1842, p. 66, pl. xv. fig. 9), from the Oligocene of the Vienna Basin, is founded upon an imperfect tooth of *Galeocerdo*, now in the Munich Museum.

Some awl-shaped teeth from the "marls of New Jersey," apparently referable to the symphysis of the upper jaw of *Notidanus*, are described under the name of *Xiphodolamia ensis*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 252, pl. xxxiv. figs. 25–30.

Genus **CHLAMYDOSELACHE**, Garman.

[Bull. Essex Institute, vol. xvi. 1884, p. 52.]

Body much elongated, slender; mouth terminal; gill-openings six, with anterior flaps of skin, the first especially large. Dentition similar in both jaws, but a median symphysial series of teeth only

[1] A. Oppel, Württ. Jahresh. vol. x. (1854), p. 62, pl. i. fig. 1; Tate & Blake, Yorksh. Lias, 1876, p. 256; A. S. Woodward, Geol. Mag. [3] vol. iii. (1886), pp. 208, 525. The described specimens are respectively in the Museums of Munich and Whitby.

[2] Beitr. Petrefakt. vi. (1843), p. 55.

[3] Mém. Soc. Paléont. Suisse, vol. iii. (1876), p. 16, pl. ii. fig. 1.

present in the mandible. Teeth with broad, backwardly-extended bases, overlapping; crown consisting of three slender, curved, subconical cusps, separated by a pair of rudimentary denticles. Notochord mainly persistent, in part replaced by feeble cyclospondylic vertebral centra.

A nearly complete description of the type specimen (female) of the single known living species, *C. anguineus*, from Japanese seas, is given by S. Garman in the Bull. Museum Comp. Zoology, Harvard College, vol. xii. no. i. (1885). Further notes, and a large figure, are published by A. Günther, Rep. Deep-Sea Fishes ('Challenger' Reports, vol. xxii. 1887, p. 2, pl. lxiv.).

Only one fossil species has hitherto been recorded, and this merely upon the evidence of detached teeth:—

Chlamydoselache lawleyi, J. W. Davis, Proc. Zool. Soc. 1887, p. 542; *incertæ sedis*, R. Lawley, Nuovi Studi sopra ai Pesci, etc., delle Colline Toscane, 1876, p. 87, pl. i. fig. 1. —Pliocene; Tuscany.

Division B.—*Two dorsal fins present; gill-clefts five in number.*

Family COCHLIODONTIDÆ.

An imperfectly definable family, apparently related to the Cestraciontidæ, but with a more specialized dentition. At least one of the transverse series of teeth encircling each ramus of the jaw is fused into a continuous curved plate, sometimes with an even coronal surface, sometimes with ridges and furrows marking the boundaries of its components; this plate increasing in size by additions to its inner margin, and the outer border gradually coiling inwards instead of becoming detached. The root and the crown are approximately of corresponding thickness, the attached surface of the former being thus almost parallel to the coronal contour. Coronal surface punctate, the punctations having no relation to the extremities of the vertical medullary canals[1].

The principal forms of teeth of this family were originally referred by Agassiz[2] to *Psammodus*, and placed with this genus in the family of Cestraciontidæ. Somewhat later, the same author recognized at least their generic distinctness, first founding the genera *Helodus*

[1] R. Owen, Odontography, vol. i. p. 59.
[2] Poiss. Foss. vol. iii. pls. xiv., xv.

and *Cochliodus* [1], and then naming others [2]. F. M'Coy [3] described many species (some already bearing Agassiz's MS. names), endeavouring to show that *Cochliodus* itself was closely related to *Placodus* (now known to be a reptile), and, by mistaking a fragment of the inwardly coiled outer border, considered that the teeth succeeded vertically, as in the Pycnodonts [4]. In 1867 [5], R. Owen founded the family of Cochliodontidæ, having already remarked [6] that "it would seem as if the several teeth of each oblique row in *Cestracion* had been welded into a single dental mass in *Cochliodus*, the proportions and direction of the rows being closely analogous." About the same year, Newberry and Worthen [7], described an American fossil proving the occurrence of small separate teeth together with the large plates in an ally of the British *Cochliodus*. In 1872, Hancock and Atthey [8] made known the presence of at least one dorsal fin-spine in the generalized genus *Pleuroplax* ("*Pleurodus*"). In 1878 and 1883, L. G. de Koninck [9], J. W. Davis [10], and St. John and Worthen [11], added much to our knowledge of the detached dental plates: and still more recently, R. H. Traquair [12] has made known the greater part of the dentition of *Psephodus*, emphasizing its generalized character, besides pointing [13] to *Pleuroplax* (*Pleurodus*) and *Pæcilodus* as affording a clue to the true homologies of the larger teeth characterizing the whole family.

It seems probable that the Cochliodontidæ possessed two dorsal fins, often provided with spines. In some beds, however, yielding Cochliodont teeth—*e. g.*, those of Ticknall and Chapel-en-le-Frith (Derbyshire), Wensleydale (Yorkshire), and Beith (Ayrshire)—dorsal fin-spines are almost or quite unknown.

The genera and species are distinguished by the form and proportions of the large "dental plates"—morphologically, compound

[1] *Tom. cit.* pp. 104, 113 (1838).
[2] *Tom. cit.* p. 174 (1843).
[3] Brit. Palæoz. Foss. (1855).
[4] *Op. cit.* p. 621.
[5] Geol. Mag. vol. iv. p. 59.
[6] Palæontology, 2nd edit. (1861), p. 128.
[7] Palæont. Illinois, vol. ii. p. 89.
[8] Nat. Hist. Trans. Northumb. and Durham, vol. iv. p. 408.
[9] Faune Calc. Carbf. Belg. pt. i. (Ann. Mus. Roy. d'Hist. Nat. Belg. vol. ii.).
[10] Trans. Roy. Dublin Soc. [2] vol. i. (1883), pp. 327–600, pls. xlii.–lxv.
[11] Palæont. Illinois, vols. vi., vii.
[12] Trans. Geol. Soc. Glasgow, vol. vii. (1884), p. 396, pl. xvi.; and Geol. Mag. [3] vol. ii. (1885), p. 340, pl. viii.
[13] Geol. Mag. [3] vol. v. (1888), p. 84.

teeth—which are nearly always, if not always, placed posteriorly upon the jaws. For convenience of description, the margin to which additions are made during growth will be termed the "inner" border, the opposite in-rolled margin the "outer" border; the other pair of sides will be named the "antero-lateral" and "postero-lateral" respectively, and a line joining these will be transverse.

The most generalized members of the family, *Helodus*, *Pleuroplax*, and *Psephodus*, will be treated first, the most specialized genus, *Deltoptychius*, and some uncertain forms, being placed last. *Pleuroplax* is the only genus in Europe certainly ranging throughout the Carboniferous Period; and in the North-American beds *Psephodus* is stated not only to occur in the earliest, but also to have the greatest vertical range in the Lower Carboniferous [1].

Genus **HELODUS**, Agassiz.

[Poiss. Foss. vol. iii. 1838, p. 104.]

As originally defined by Agassiz, the generic name *Helodus* is applicable to all the detached anterior teeth of Cochliodonts (*see* p. 218); but, in the absence of definite evidence, it seems advisable to restrict the term provisionally to the type species, which represents a genus still awaiting elucidation. This fish is obviously very closely related to *Pleuroplax*, as shown both by the dentition and the dorsal fin-spine [2]; but in the known examples of the last-named genus all the teeth are described as fused into plates, while in the typical *Helodus* no such arrangement has been discovered [3]. If, indeed, the latter observation be confirmed, the genus does not strictly fall under the accepted definition of the Cochliodontidæ, and some modification will be required; but there can be no doubt that in whatever family *Pleuroplax* be placed, the type species of *Helodus* must follow. The dental crown is tumid, and the coronal surface coarsely punctate.

Helodus simplex, Agassiz.

1838. *Helodus simplex*, L. Agassiz, Poiss. Foss. vol. iii. p. 104, pl. xix. figs. 8–10.

1861. *Helodus simplex*, J. W. Salter, Foss. S. Welsh Coal Field (Mem. Geol. Surv.—Iron Ores Gt. Brit. pt. iii.), p. 225, pl. i. fig. 17.

[1] St. John and Worthen, Palæont. Illinois, vol. vii. (1883), p. 59.

[2] J. Ward, [Proc.] N. Staffs. Nat. Field-Club, 1875, p. 221.

[3] R. H. Traquair, Geol. Mag. [3] vol. v. 1888, p. 84.

1872. *Helodus simplex*, Hancock & Atthey, Nat. Hist. Trans. Northumb. & Durham, vol. iv. p. 422.

1875. *Helodus simplex*, J. Ward, [Proc.] N. Staffs. Nat. Field-Club, p. 220.

1875. *Helodus simplex*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. iii. p. 101, figs. xlv.–xlviii.

1888. *Helodus simplex*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 84.

Type. Detached teeth; British Museum (in part).

Dental crown very variable in form, but much elevated and generally obtuse, attaining a maximum breadth of 0·015. The species is still imperfectly known, and many of the specimens mentioned below are only provisionally assigned to it.

Form. & Loc. Coal Measures: Staffordshire, Shropshire, Yorkshire, and Northumberland; South Wales; Lanarkshire.

P. 488. Tooth figured by Agassiz, *tom. cit.* pl. xix. fig. 9; Silverdale, Staffordshire. *Egerton Coll.*

P. 2906–7. Two groups of naturally-associated imperfect teeth, with remains of cartilage; Longton, Staffordshire. *Enniskillen Coll.*

P. 2908. Fragment of trunk, with imperfect dorsal fin-spine; Longton. *Enniskillen Coll.*

P. 2909. Six comparatively pointed teeth; Longton. *Enniskillen Coll.*

P. 5160. Ten teeth; Longton. *Purchased*, 1885.

P. 2910. Four teeth; Fenton, Staffordshire. *Enniskillen Coll.*

P. 5159. Two naturally-apposed series of four small teeth; Fenton. *Purchased*, 1885.

P. 1440. Two teeth; Fenton and Silverdale. *Egerton Coll.*

21422, 21975. Five detached teeth; also six smaller teeth naturally arranged in two adjoining series, doubtfully assigned to this species; Carluke, Lanarkshire. *Purchased*, 1847–8.

P. 2905. Associated teeth; Carluke. *Enniskillen Coll.*

P. 2283. Two teeth; Carluke. *Presented by George Griffiths, Esq.*, 1882.

The following specimens may indicate a hitherto unknown species:—

P. 5157–8. Tooth measuring 0·019 in the longer diameter, associated with small teeth; also two associated teeth and fragments pertaining to an equally large fish: Fenton.
Purchased, 1885.

Genus **PLEUROPLAX**, nomen nov.

Syn. *Pleurodus*, Hancock & Atthey (non *Pleurodon*, Wood, 1840, nec Harlan, 1842), Nat. Hist. Trans. Northumb. & Durham, vol. iv 1872, p. 408.

Rami of jaws meeting at an acute angle: teeth, so far as known, mostly fused into continuous transverse plates, few in number, carinated, and having indented antero- and postero-lateral borders, marking the free extremities of the components. Body depressed, covered with fine shagreen; dorsal fin-spine laterally compressed, broad, smooth, or ornamented with delicate longitudinal striæ.

Pleuroplax rankinei, Hancock & Atthey.

1843. *Pleurodus rankinei*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).
1843. *Pleurodus affinis*, L. Agassiz, *loc. cit.* (name only).
1861. *Pleurodus affinis*, J. W. Salter (*ex* Egerton, MS.), Foss. S. Welsh Coal Field (Mem. Geol. Surv.—Iron Ores Gt. Brit. pt. iii.), p. 225 pl. i. figs. 18, 19 (figures only).
1861. *Pœcilodus* (?) sp., J. W. Salter (*ex* Egerton, MS.), *loc. cit.* p. 225, pl. i. fig. 20 (abraded tooth, figure only).
1872. *Pleurodus rankinii*, A. Hancock & T. Atthey, Nat. Hist. Trans. Northumb. & Durham, vol. iv. p. 408, pl. xv. fig. 1.
1873. *Pleurodus*, T. P. Barkas, Coal Meas. Palæont. p. 18, pl. i. figs. 24–27.
1874. *Pleurodus affinis*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. iii. p. 6, figs. xxxvi.–xxxix.
1875. *Pleurodus affinis*, J. Ward, [Proc.] N. Staffs. Nat. Field-Club, p. 223.
1875. *Pleurodus rankinii*, J. Ward, *loc. cit.* p. 222, fig. 13.
1879. *Pleurodus affinis*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxv. p. 181, pl. x. figs. 1–11.

Type. Associated dental plates, and anterior portion of body with dorsal fin-spine; Museum of Newcastle-upon-Tyne.

Axial rounded carina of the dental crown prominent, rarely marked by faint transverse sulci; unabraded coronal surface smooth, or with delicate irregular wrinkles near the margin. Anterior

dental plates with little or no lateral expansion: posterior dental plates with large more or less unsymmetrical lateral "wings," broadest in the middle, diminishing to the outer and inner margin.

The dental plates vary considerably in form, but they are associated in such a manner that, as already suggested by Ward and W. J. Barkas, it seems probable that they pertain to a single species. A small jaw is described by W. J. Barkas indicating the presence of about three dental plates in each ramus, the anterior being relatively narrower than the posterior; a portion of a fish is made known by Hancock and Atthey, displaying about a dozen dental plates in the mouth, fine shagreen, and a dorsal fin-spine; and several varieties of the narrow plates, with dorsal spines, are described and figured by J. W. Davis. The tooth figured by Salter as *Pœcilodus* (?) sp. is evidently a much abraded specimen.

Form. & Loc. Coal Measures: North and South Wales, Staffordshire, Yorkshire, Northumberland, and the Scotch Coalfield.

P. 1416. Small imperfect dental plate, with broad lateral "wings," strongly furrowed; Ruabon, N. Wales. This fossil bears Agassiz's MS. label, "*Pleurodus affinis*," and was intended to be described and figured as the type of the genus and species. *Egerton Coll.*

P. 5162. Three narrow dental plates resembling the one figured by Ward (*loc. cit.*) under the name of *P. rankinii*; Longton, N. Staffordshire. *Purchased*, 1885.

P. 1415. Eight dental plates, variously abraded, mostly of the narrow form figured by J. W. Davis (*loc. cit.*), but one of the broader type, and some smaller; Bone-bed of Betterbed Coal (Lower Coal Measures), Lowmoor, near Halifax, Yorkshire. *Egerton Coll.*

P. 2481. Eight similar specimens, one of very large size (long axis measuring 0·02), from the same locality.
Enniskillen Coll.

21422. Twenty examples, variously abraded, with lateral "wings" well developed; Carluke, Lanarkshire. *Purchased*, 1847.

21975. Eight narrow dental plates, one showing a tendency towards division into teeth very similar to those of *Helodus simplex*; Carluke. *Purchased*, 1848.

33300. Two specimens; Carluke. *Purchased*, 1858.

P. 1414. Three fragmentary dental plates, one showing a transverse suture, another with broad lateral wings, and the third of the form figured by J. W. Davis, *loc. cit.* figs. 6, 7; Carluke. *Egerton Coll.*

P. 2281. Fourteen specimens; Carluke. *Enniskillen Coll.*

P. 2480, P. 2482. Twelve dental plates, mostly abraded, of all the different forms; Carluke. An unworn fragment shows a median longitudinal wrinkle, with short branches, and small wrinkles directed towards the median carina upon the lateral prolongations. *Enniskillen Coll.*

Pleuroplax attheyi (W. J. Barkas).

1843. *Pœcilodus angustus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).

1874. *Pœcilodus attheyi*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. iii. p. 57, figs. xl.–xliv.

Type. Detached dental plate.

Axial carina of the dental crown low, but sharply angulated, divided by deep transverse sulci, corresponding to the divisions between the incompletely coalesced components. Dental plates approaching an elongated oval in form, usually broader at one extremity than the other, without prominent median lateral expansions.

Many of the dental plates from the Scotch Coalfield are twice as large as the typical examples from Northumberland.

Form. & Loc. Coal Measures: Northumberland and Lanarkshire.

21423. Eight dental plates, some abraded, and the largest 0·012 in length; Carluke, Lanarkshire. Two examples are shown, of the natural size, in Pl. VI. figs. 10, 11. *Purchased*, 1847.

P. 2466. Four large examples, one unabraded; Carluke. *Enniskillen Coll.*

P. 2282. Two specimens; Carluke. *Enniskillen Coll.*

Pleuroplax woodi, Davis.

1874. *Pleurodus*, sp., W. J. Barkas, Monthly Rev. Dental Surgery, vol. iii. p. 9.

1883. *Pleurodus woodi*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 458, pl. lix. figs. 12–15.

1884. *Pleurodus woodi*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 624, pl. xxvii. figs. 14–17.
1886. *Pleurodus woodi*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 156.

Type. Detached dental plates; Reed Collection, York Museum.

Axial carina of the dental crown narrow, rounded, divided by transverse sulci, corresponding to the divisions between the incompletely coalesced components; lateral notches very deep.

The dental plates of this species were first described by W. J. Barkas, but were not figured until 1883, when J. W. Davis proposed the name by which the species is now known.

Form. & Loc. Upper Carboniferous Limestone: Yorkshire and Derbyshire.

P. 4887. Eight dental plates; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 5357. An abraded dental plate, probably referable to this species; Ticknall, near Melbourne, S. Derbyshire. *Wilson Coll.*

Dental plates of a species of *Pleuroplax*, from the Lower Carboniferous Limestone of Belgium, have been described under the name of *Tomodus laciniatus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 61, pl. vi. fig. 20.

Genus **PSEPHODUS**, Agassiz.

[Morris and Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. 1862, p. 101 [1].]

Syn. *Helodus*, L. Agassiz, Poiss. Foss. vol. iii. 1838, p. 104 (in part).
Lophodus, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, vol. xxxvii. pt. ii. 1864, p. 160.
Aspidodus, Newberry & Worthen, Pal. Illinois, vol. ii. 1866, p. 92.
Tæniodus, St. John & Worthen, Pal. Illinois, vol. vii. 1883, p. 75 (in part).

At least one series of the teeth upon each ramus of the jaw represented by a large gently curved plate, quadrangular, without coronal ridges or any marked inrolment of the outer border, and having at least the antero-lateral and postero-lateral margins of the crown

[1] The name only is here mentioned and applied to the species previously described and figured by M'Coy and Portlock under the name of *Cochliodus magnus*. The type species being thus already well-defined in 1862, the generic name is generally regarded as dating from that year.

more or less crenulated. Other side-teeth with gently rounded crowns and crenulated margins: symphysial teeth smaller and feebly prehensile.

A considerable portion of the dentition of the type species of the genus has been described by R. H. Traquair [1]. It appears that there are two forms of the large dental plates, one probably in each jaw; and it seems likely that there was originally at least one series of small teeth situated posteriorly to these. The "upper" dental plate has a relatively greater antero-posterior measurement than the "lower," and is less curved round the supporting cartilage.

Psephodus magnus (M'Coy).

1843. *Cochliodus magnus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).
1843. *Helodus planus*, L. Agassiz, *tom. cit.* p. 173 (name only).
1843. ***Helodus didymus***, L. Agassiz, *tom. cit.* p. 173 (name only).
1843. *Cochliodus magnus*, J. E. Portlock, Rep. Geol. Londonderry, p. 466, pl. xiv. *a*. fig. 4 (figure only).
1843. *Helodus planus* = *Cochliodus magnus*, J. E. Portlock, *op. cit.* p. 462.
1855. *Cochliodus magnus*, F. M'Coy, Brit. Palæoz. Foss. p. 622.
1855. *Helodus planus*, F. M'Coy, *op. cit.* p. 631, pl. 3 I. figs. 12–15.
1855. *Helodus didymus*, F. M'Coy, *op. cit.* p. 630, pl. 3 I, figs. 18–20 (in part).
1855. *Helodus lævissimus*, F. M'Coy, *op. cit.* p. 630 (in part).
1855. ***Helodus rudis***, F. M'Coy, *op. cit.* p. 631, pl. 3 K. fig. 4.
1862. *Psephodus magnus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).
(?) 1878. *Psephodus magnus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. p. 60, pl. iv. fig. 16 (*non* figs. 14, 15, 17).
(?) 1878. *Tomodus craigi*, L. G. de Koninck, *op. cit.* pt. i. p. 61, pl. iv. fig. 8, pl. vi. figs. 18, 19.
1883. *Psephodus magnus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 439, pl. lv. figs. 1–14.
1883. *Lophodus lævissimus*, J. W. Davis, *tom. cit.* p. 404, pl. li. fig. 18 (in part).
1883. *Lophodus didymus*, J. W. Davis, *tom. cit.* p. 407, pl. li. fig. 21 (in part).
1883. ***Helodus rudis***, J. W. Davis, *tom. cit.* p. 457, pl. lix. fig. 11.
1883. Selachian Fish, J. Coutts, Trans. Geol. Soc. Glasgow, vol. vii. p. 164.
1885. *Psephodus magnus*, R. H. Traquair, Trans. Geol. Soc. Glasgow, vol. vii. p. 392, pl. xvi.; and Geol. Mag. [3] vol. ii. p. 337, pl. viii.
1886. *Psephodus magnus*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 151.

[1] Trans. Geol. Soc. Glasgow, vol. vii. (1884), p. 396, pl. xvi.; also Geol. Mag. [3] vol. ii. (1885), p. 337, pl. viii.

Type. Detached large dental plates.

The type species, of comparatively large size, the antero-posterior measurement of the "upper" dental plates being sometimes as great as 0·05, and the distance from the outer to the inner border 0·035. Outer margin of "upper" dental plate straight, inner margin nearly straight for its greater extent anteriorly and sharply curved upwards behind; coronal contour slightly raised along a line connecting the bend of the inner border with the posterior extremity of the outer border, and the abraded hollows in worn teeth apparently confined to the area in advance of this elevation. "Lower" dental plate gently and more uniformly rounded than the "upper;" inner border curved throughout its length.

The "upper" dental plate is described as "posterior" by M'Coy, and is figured by Davis (*loc. cit.* pl. lv. figs. 1, 13, 14) and Traquair (*loc. cit.* pl. xvi. fig. 4); the "lower" dental plate is described as "middle" by M'Coy, and is figured by Davis (*loc. cit.* pl. lv. figs. 2, 10) and Traquair (*loc. cit.* pl. xvi. fig. 3).

The finest example of the dentition yet known is that from the Cement Limestone of East Kilbride, Lanarkshire, described by Coutts and Traquair. According to the latter it exhibits, in addition to the ordinary large dental plates, teeth identifiable with *Helodus planus*, *H. radis*, *H. lævissimus*, and *H. didymus*.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland; Lanarkshire, Scotland; Northumberland and Somersetshire, England. Carboniferous Limestone (various horizons): Ayrshire, Scotland; Westmoreland and Derbyshire, England; Denbighshire and Flintshire, N. Wales.

(i.) *Armagh, Ireland.*

Unless otherwise stated, the following specimens are from the Enniskillen Collection:—

P. 2394, P. 2406. Three "upper" dental plates, figured by J. W. Davis, *loc. cit.* pl. lv. figs. 1, 13, 14. As already remarked by Traquair (*loc. cit.* p. 400) the inner margin of the first is erroneously placed externally; the coronal surface of the second is much excavated by wear, and the postero-lateral and inner margins are abraded and broken.

P. 2409. Twenty-five "upper" dental plates, of large size, some much worn, and others showing marks of incomplete division into teeth.

P. 2409 a. Five large dental plates of irregular shape.

P. 2408. Three immature examples of the "upper" dental plate.

P. 1395. Ten "upper" dental plates. *Egerton Coll.*

28018, 28724, 41161. Fifteen "upper" dental plates.
Purchased, 1853, 1868.

P. 2395, P. 2403. Two "lower" dental plates, figured by J. W. Davis, *loc. cit.* pl. lv. figs. 2, 10.

P. 2407. Fourteen "lower" dental plates, some showing marks of incomplete division into teeth.

P. 1395 a. Five small "lower" dental plates. *Egerton Coll.*

26042, 28724 a, 41161 a. Five "lower" dental plates.
Purchased, 1851, 1853, 1868.

P. 2397. Three teeth, naturally arranged, the group having precisely the outline of an "upper" dental plate; figured by J. W. Davis, *loc. cit.* pl. lv. fig. 4.

P. 2396, P. 2398-P. 2404. Eight gently rounded teeth—the so-called *Helodus planus*,—one associated with two narrow broken teeth; figured by J. W. Davis, *loc. cit.* pl. lv. figs. 3, 5-9, 11, 12.

P. 2410, P. 2614 a. Sixty similar teeth; seven in associated pairs.

P. 2604. Forty-five similar teeth, mostly very narrow.

P. 1399, P. 1438, P. 1476. Sixteen similar specimens.
Egerton Coll.

28746-7, 28750, 38505, 41163. Thirty-three similar specimens.
Purchased.

P. 2604 a. Eight small narrow teeth, some of the form figured by J. W. Davis under the name of *Helodus lævissimus*, *loc. cit.* pl. li. fig. 18*a*.

(ii.) *Lanarkshire and Ayrshire, Scotland.*

46048. Two "upper" and three "lower" dental plates, smaller than the adult specimens from Armagh; Beith, Ayrshire.
Presented by Robert Craig, Esq., 1874,

46049. Two small flat teeth—the so-called *Helodus planus*; Beith.
Presented by Robert Craig, Esq., 1874.

P. 259. "Upper" dental plate, differing from the more typical examples of this species in its relatively less antero-posterior measurement and more angulated contour of the crown; Beith. *Purchased*, 1880.

(iii.) *Westmoreland.*

P. 2411. Five typical "upper" dental plates, two broken; Kendal. *Enniskillen Coll.*

P. 1396. Two "upper" dental plates, one of the largest size, the other smaller; Kendal. *Egerton Coll.*

(iv.) *Derbyshire.*

46814. "Upper" and portion of "lower" dental plate. *Gilbertson Coll.*

P. 5347, P. 5347 a. Two "upper" and two "lower" dental plates, of comparatively small size; from a bed of shale in the Upper Carboniferous Limestone, Ticknall, near Melbourne, South Derbyshire. *Wilson Coll.*

(v.) *Bristol, Gloucestershire.*

34978-9. Small abraded "upper" dental plate, and "lower" dental plate exhibiting strong wrinkling of the inner coronal border, the ridges and furrows being at right angles to the margin. *Purchased*, 1860.

41154. "Upper" dental plate, with two small clefts, one in each lateral border, apparently marking the limits of the original tooth forming the outermost portion of the plate. *Purchased*, 1868.

P. 2412. "Upper" dental plate. *Enniskillen Coll.*

P. 5227. Two "upper" and one "lower" dental plate. *Presented by J. E. Lee, Esq.*, 1885.

P. 1477. Two small, almost rectangular teeth, with gently rounded coronal contour. *Egerton Coll.*

(vi.) *North Wales.*

P. 5348. "Lower" dental plate; Trevor, Denbighshire. *Wilson Coll.*

Psephodus lævissimus (Agassiz).

1838. *Helodus lævissimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 104, pl. xiv. figs. 1–14 (*non* fig. 15).

Type. Detached teeth and dental plates; Bristol Museum (in part).

A small species, the "upper" dental plate measuring about 0·013 antero-posteriorly. Inner margin of "upper" plate nearly straight anteriorly for more than half its length, then sharply bent upwards almost at right angles and equally straight; coronal contour raised into a prominent narrow ridge along a line connecting the bend of the inner border with the posterior extremity of the outer border. "Lower" dental plate gently and more uniformly rounded than the "upper;" inner margin very slightly curved.

The "upper" dental plate is shown by Agassiz, *loc. cit.* fig. 13, but the specimen is imperfect and the drawing scarcely accurate; the "lower" plate is apparently the original of fig. 14, *loc. cit.*, and exhibits two small flattened teeth (erroneously shown as one long tooth) adjoining its postero-lateral margin. The original of fig. 15, *loc. cit.*, is very suggestive of *Tomodus*, and cannot be associated with *P. lævissimus* upon present evidence. It is also uncertain whether many of the so-called anterior teeth of this species are correctly so determined, some being very large and perhaps belonging to other unknown Cochliodonts.

Form. & Loc. Lower Carboniferous (Bone-bed in Lower Limestone Shales): Avon Gorge, near Bristol, Gloucestershire.

P. 2620. A series of thirty teeth, comprising two much worn examples of the "upper" dental plate and imperfect specimens of the "lower;" the anterior teeth resemble those figured by Agassiz, and many are of remarkably large size, if truly referable to this species. There appears to be a third form of dental plate, closely resembling the "lower" in shape, but more convex. *Enniskillen Coll.*

P. 2645. Tooth approaching the form of the so-called *Helodus mammillaris*. *Enniskillen Coll.*

P. 1434 a. Two "upper" dental plates, one shown of the natural size in Pl. VI. fig. 16. *Egerton Coll.*

P. 1434. Twenty-four anterior teeth, and one imperfect small dental plate, apparently like the "lower," but more convex. Some of the elongated teeth exhibit wide trans-

verse wrinkles upon one of the longer margins, suggesting an approximation towards the teeth of *Orodus*.

Egerton Coll.

44857. One "upper" dental plate, another suggestive of the "lower" dental plate fused with one small adjoining tooth, and six anterior (*Helodus*-shaped) teeth of large size. *Presented by Benjamin Bright, Esq.*, 1873.

P. 5858. Two small dental plates, resembling the "lower," but more convex, and an elongated anterior tooth with a transverse suture dividing the crown into two parts.

P. 4213. A very large dental plate, perhaps of this species, and apparently consisting of three of the *Helodus*-shaped teeth fused together. *Enniskillen Coll.*

Psephodus salopiensis, sp. nov.

Type. "Upper" dental plate shown in Pl. VI. fig. 14.

A small species, the "upper" dental plate usually measuring about 0·012 antero-posteriorly. Outer margin of "upper" dental plate outwardly curved, and the inner margin also gently curved throughout its length, the bend being almost in the middle; coronal contour gently, though considerably, raised along a line connecting the bend of the inner border with that of the outer. "Lower" dental plate (*probably*) strongly convex, very oblique; antero-lateral border marked by large indentations; inner border curved.

The complete dentition of this species not yet being known, and so many other Cochliodonts occurring upon the same horizon, it is impossible to identify its anterior teeth, which are probably included among the anterior teeth described below as of the form of *Helodus lævissimus*, auctorum.

Form. & Loc. Carboniferous Limestone: Shropshire.

42189. "Upper" dental plate, shown in Pl. VI. fig. 14, of the natural size, forming the type specimen; Oreton.

Baugh Coll.

42188, 42215. Two smaller abraded examples; Oreton.

Baugh Coll.

42230. Supposed "lower" dental plate, shown in Pl. VI. fig. 15, of the natural size; Oreton. A very similar dental plate is met with in a Russian species of *Psephodus* described

under the name of *Helodus dentatus*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 159, pl. iii. fig. 15. *Baugh Coll.*

42187. Two smaller but similar dental plates; Oreton. *Baugh Coll.*

Psephodus dubius, sp. nov.

Type. "Lower" dental plate shown in Pl. VI. figs. 13, 13*a*.

The provisional name of *P. dubius* may be given to a species indicated by the large dental plate shown in the figure. This specimen corresponds most closely in its characters and dimensions to the "lower" dental plate of *P. magnus*, exhibiting a similar coronal contour and coarsely crimped borders, but having a relatively much less antero-posterior measurement, and the outer portion of the plate not being so abruptly truncated but prolonged into an inrolled point. In addition to this gradual inrolment the plate is sharply bent along an oblique transverse line about its middle, and the marks of wear appear to be confined to the area outside this flexure.

Form. & Loc. Carboniferous Limestone: Shropshire.

P. 4209. Type-specimen; Oreton. *Enniskillen Coll.*

42183. A broken specimen, showing the considerable thickness of the dental plate, and faint transverse sutures near its inner margin; Oreton. *Baugh Coll.*

P. 227 a. Smaller dental plate, much worn, showing the inrolment of the outer apex, and transverse sutural lines across the crown near its inner margin; profile outline restored in Pl. VI. fig. 13*a*; Oreton. *Weaver-Jones Coll.*

42191-93. Three small dental plates of similar form, either pertaining to young of this species, or, if the so-called "lower" dental plates of *P. salopiensis* prove to be erroneously identified above, perhaps referable to the latter; Oreton. *Baugh Coll.*

P. 227 b. Small "upper" dental plate, having an antero-posterior measurement of 0·016, and, so far as preserved, very similar in form to the corresponding dental plate of *P. magnus*; it is shown of the natural size in Pl. VI. fig. 12, and may possibly be referable to this species; Oreton. *Weaver-Jones Coll.*

Two undetermined species of *Psephodus*, remarkable for the rela-

tively small antero-posterior measurement of the "upper" dental plate, are indicated by the following specimens:—

23712. A small dental plate, shown, of the natural size, in Pl. VI. fig. 17; Lower Carboniferous Limestone, Hook Point, Wexford, Ireland. *Purchased*, 1849.

P. 227 c. A larger corresponding plate, with prominently-coloured transverse bands, shown, of the natural size, in Pl. VI. fig. 18; Carboniferous Limestone, Orcton.
Weaver-Jones Coll.

The following species have also been founded upon detached dental plates, but there are no examples in the Collection:—

Psephodus crenulatus, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 67: *Aspidodus crenulatus*, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 93, pl. viii. figs. 3–11; also J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78 (1879), p. 341: *Aspidodus convolutus*, Newberry & Worthen, *tom. cit.* p. 94, pl. viii. fig. 12.—Chester Limestone; Illinois and Kentucky.

Psephodus dentatus: *Helodus dentatus*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 159, pl. iii. figs. 12–16.—Lower Carboniferous Limestone: Government of Toula, Russia. ? *Helodus dentatus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 40, pl. iv. fig. 18.—Lower Carboniferous Limestone; Tournai, Belgium.

Psephodus indicus, W. Waagen, Pal. Ind. ser. 13, pt. ii. (1880), p. 73, pl. vii. figs. 3, 5.—Productus Limestone; Salt Range, India.

Psephodus latus, St. John & Worthen, *op. cit.* vol. vii. p. 72, pl. ii. figs. 1–3.—St. Louis Limestone; Illinois, Missouri.

Psephodus minor, H. Trautschold, Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 57, pl. vii. figs. 9, 10 (*non* figs. 11, 12).—Carboniferous Limestone; Mjatschkowa, Moscow.

Psephodus obliquus, St. John & Worthen, *op. cit.* vol. vii. p. 66, pl. i. figs. 1–5.—Kinderhook Limestone; Iowa.

Psephodus placenta, St. John & Worthen, *op. cit.* vol. vii. p. 69, pl. ii. figs. 5–8: *Helodus placenta*, Newberry & Worthen, *op. cit.* vol. ii. p. 80, pl. v. fig. 4.—Kinderhook Limestone; Iowa.

Psephodus regularis: *Teniodus regularis*, St. John & Worthen, *op. cit.* vol. vii. p. 77, pl. xiii. fig. 11.—Warsaw Limestone; Indiana.

Psephodus simplex, J. W. Davis, Geol. Mag. [3] vol. iii. p. 151, figs. 1, 2.—Carboniferous Limestone; Derbyshire.

(?) *Psephodus symmetricus*, St. John & Worthen, *op. cit.* vol. vii. p. 71, pl. i. figs. 6, 7.—Kinderhook Limestone; Iowa.

The so-called *P. lunulatus*, St. John & Worthen (*op. cit.* vol. vii. p. 74, pl. ii. fig. 4), from the Chester Limestone of Illinois, appears to be founded upon a specifically indeterminable anterior tooth of *Psephodus*; and very doubtful, also, is *P.* (?) *reticulatus*, St. John & Worthen (*op. cit.* vol. vi. 1875, p. 417, pl. vi. figs. 19–24), from the Kinderhook Limestone of Iowa. Other evidence of the genus, from the Lower Carboniferous of Russia, has been described and figured by Semenov and Möller, Bull. Acad. Imp. Sci. St. Pétersb. vol. vii. (1864), p. 234, pl. i. fig. 10 (? and other figs.); and a doubtful tooth from the Salt Range, India, is named *P. depressus*, W. Waagen, *loc. cit.* p. 75, pl. vii. fig. 4.

A tooth from the Keokuk Limestone of Illinois, very suggestive of a broken example of *Psephodus*, has also been described under the name of *Trigonodus minor*, Newberry & Worthen (Pal. Illinois, vol. ii. 1866, p. 112, pl. xi. fig. 7); and a second example is recorded from the St. Louis Limestone of Indiana (J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78 (1879), p. 341).

Genus **SANDALODUS,** Newberry & Worthen.

[Pal. Illinois, vol. ii. 1866, p. 102.]

Syn. *Trigonodus*, Newberry & Worthen, *tom. cit.* 1866, p. 111 (in part).
Vaticinodus, St. John & Worthen, Pal. Illinois, vol. vii. 1880, p. 80.
Orthopleurodus, St. John & Worthen, *tom. cit.* p. 190 (in part).

Dental plates of "upper" jaw triangular in outline, slightly inrolled, having the antero- and postero-lateral borders each considerably longer than the inner margin. Coronal contour undulating in transverse section, the anterior portion raised into a low rounded longitudinal ridge, passing into a slightly hollowed posterior area. Dental plates of "lower" jaw subtriangular or club-shaped in outline, with one or two pointed extremities, considerably inrolled, and the longer axis approximately in an antero-posterior direction; coronal ridges and hollows few or absent.

Sandalodus morrisii, Davis.

1862. *Deltodus* sp., Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 105, pl. iii. figs. 1–3.

(?) 1862. *Deltodus* sp., Morris & Roberts, *loc. cit.* pl. iii. fig. 4.

1883. *Sandalodus morrisii*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 437, pl. liv. figs. 1-6.
1883. *Vaticinodus* sp., St. John & Worthen, Pal. Illinois, vol. vii. p. 81.
1883. *Deltodopsis* sp., St. John & Worthen, *tom. cit.* p. 160.

Type. Detached dental plates; British Museum.

A very large species, the long axis of the "upper" dental plate attaining a length of 0·12, and its maximum breadth being about 0·055. "Upper" dental plate with anterior ridge, extending from the outer apex to the inner border, prominent, its summit angulated, placed very near to the antero-lateral border. "Lower" dental plate much thickened towards the sharply rounded posterior angle, and the root extending beyond; coronal surface moderately convex, faintly exhibiting antero-posterior elevations and depressions in its anterior portion.

As already remarked by Davis, the association of the two forms of large teeth ascribed to this species, both in the Limestone of Bristol and Oreton, seems sufficient proof of their pertaining to one and the same fish. The so-called genus *Vaticinodus* also appears to the present writer superfluous, and may be conveniently deemed a synonym of *Sandalodus*; indeed the type species, *V. vetustus*, appears almost specifically indistinguishable from *S. morrisii*.

Form. & Loc. Lower Carboniferous Limestone: Gloucestershire and Shropshire.

(i.) *Triangular Variety (? Upper Jaw).*

P. 202-3. Type specimens figured by Morris and Roberts, *tom. cit.* pl. iii. figs. 2, 3; Oreton, Shropshire. *Weaver-Jones Coll.*

P. 207-9. Three specimens; Oreton. *Weaver-Jones Coll.*

42175–42180. Six specimens; Oreton. *Baugh Coll.*

41191. Two imperfect specimens, one small; Oreton. *Purchased*, 1868.

P. 2484, P. 2487. Two broken dental plates, the first figured by Davis, *tom. cit.* pl. liv. fig. 6; Oreton. *Enniskillen Coll.*

P. 4717. Very large dental plate, measuring 0·12 from the outer apex to the inner border; Oreton. *Purchased*, 1884.

36194. Fragment of small dental plate; Oreton. *Purchased*, 1861.

P. 215. Small dental plate, probably of a young individual of this species, showing a deep suture-like transverse line near the inner margin: Oreton. The specimen is figured by Morris & Roberts, *loc. cit.* pl. iii. fig. 4, and is associated

with a small quadrilateral flat tooth. A second example of the latter occurs in the Collection (No. 42230, *Baugh Coll.*), and it would be comprised under the accepted definition of *Psammodus*, like the so-called *P. salopiensis* (*supra*, p. 105). The fact, however, that small quadrangular flat teeth have been found bordering a dental plate of *Psephodus lævissimus* (*supra*, p. 181) suggests the possibility of a similar arrangement in *Sandalodus*.

Weaver-Jones Coll.

P. 216. Three similar triangular dental plates, one still smaller and showing two sutures parallel to the inner margin; Oreton. *Weaver-Jones Coll.*

46909. Medium-sized dental plate; Bristol. *Purchased*, 1875.

(ii.) *Incurved Rounded Variety* (*? Lower Jaw*).

P. 2483. P. 2485–6. Type specimen figured by Morris & Roberts, *tom. cit.* pl. iii. fig. 1; also fragments of two smaller specimens; Oreton. *Enniskillen Coll.*

P. 204–6. Three dental plates; Oreton. *Weaver-Jones Coll.*

42202–9. Eight fragmentary dental plates; Oreton. *Baugh Coll.*

42210. Small dental plates; Oreton. *Baugh Coll.*

36000, 37986, 41192. Three imperfect dental plates; Oreton. *Purchased.*

Sandalodus minor, Davis.

1884. *Sandalodus minor*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 626, pl. xxvi. fig. 17.

Type. Detached dental plate; York Museum.

A very small species. "Lower" dental plate narrow, pointed at one extremity, broader and rounded at the other; crown raised into a low rounded longitudinal ridge.

Form. & Loc. Upper Carboniferous Limestone: Yorkshire.

P. 4894. "Lower" dental plate; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

Sandalodus angustus, Newberry & Worthen.

1866. *Sandalodus angustus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 103, pl. x. fig. 3.

Type. "Lower" dental plate.

A small species, the long axis of the "lower" dental plate mea-

suring about 0·022. This plate is narrow, compressed, and pointed at one extremity, with the crown raised into a high median angulated ridge.

Form. & Loc. Keokuk Limestone (Lower Carboniferous): Illinois, U. S. A.

P. 2488. Typical dental plate; Warsaw, Illinois. *Enniskillen Coll.*

Sandalodus carbonarius, Newberry & Worthen.

1866. *Sandalodus carbonarius,* Newberry & Worthen, Pal. Illinois, vol. ii. p. 104, pl. x. figs. 4, 5.

1866. *Deltodus angularis,* Newberry & Worthen, *tom. cit.* p. 97, pl. ix. fig. 1.

(?) 1870. *Deltodus* (?) *angularis,* O. St. John, Proc. Amer. Phil. Soc. vol. xi. p. 437.

(?) 1872. *Deltodus* (?) *angularis,* O. St. John, in Hayden's Final Rep. U.S. Geol. Surv. Nebraska, p. 244, pl. vi. fig. 18.

1883. *Orthopleurodus carbonarius,* St. John & Worthen, Pal. Illinois, vol. vii. p. 192, pl. xiii. figs. 6–8.

Type. "Lower" dental plate.

A small species. "Lower" dental plate sub-spatulate, expanded anteriorly, becoming narrow and pointed behind; crown low, with a faint angulated ridge along the long axis of the plate near the straighter margin. "Upper" dental plate originally described as *Deltodus angularis.*

Form. & Loc. Coal-Measures: Illinois, Kansas, Indiana, Iowa, (?) Nebraska, and Missouri, U.S.A.

P. 2489. Dental plate, wanting narrowed extremity; La Salle, Illinois. *Enniskillen Coll.*

Sandalodus lævissimus, Newberry & Worthen.

1866. *Sandalodus lævissimus,* Newberry & Worthen, Pal. Illinois, vol. ii. p. 104, pl. x. figs. 6–8.

1866. *Sandalodus grandis,* Newberry & Worthen, *tom. cit.* p. 105, pl. x. fig. 9.

1866. *Deltodus grandis,* Newberry & Worthen, *tom. cit.* p. 101, pl. ix. fig. 9.

1866. *Cochliodus? crassus,* Newberry & Worthen, *tom. cit.* p. 91, pl. viii. fig. 2.

1866. *Psammodus? semicylindricus,* Newberry & Worthen, *tom. cit.* p. 109, pl. xi. fig. 4.

1866. *Psammodus? rhomboideus,* Newberry & Worthen, *tom. cit.* p. 110, pl. xi. fig. 6.

(?) 1879. *Deltodus grandis*, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78, p. 344.

1883. *Sandalodus lævissimus*, St. John & Worthen, Pal. Illinois, vol. vii. p. 186, pl. xii. figs. 8, 9 (in part).

Type. "Lower" dental plate.

The long axis of the "lower" posterior dental plate attaining a length of 0·09, and its maximum breadth about 0·03; obtuse anterior ridge angulated. "Lower" posterior dental plate subtriangular: coronal surface considerably elevated, with one or two slight median ridges extending from the outer to the inner border, becoming angulated outwards.

The above synonymy is copied from Messrs. St. John and Worthen, who have had the opportunity of studying the original specimens. The same authors doubtfully ascribe a third form of tooth, much inrolled, to a "median" position upon the mandible of this species; they also reverse the terms "upper" and "lower" as here provisionally employed.

Form. & Loc. Keokuk Limestone (Lower Carboniferous): Iowa, Illinois, and Missouri, U.S.A. (?) St. Louis Limestone: Indiana

P. 2491. Incomplete "lower" dental plate; Warsaw, Illinois.
Enniskillen Coll.

P. 2490. Two similar, but larger, specimens; Warsaw, Illinois.
Enniskillen Coll.

Sandalodus complanatus (Newberry & Worthen).

1866. *Deltodus complanatus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 98, pl. ix. fig. 4.

1866. *Trigonodus major*, Newberry and Worthen, *tom. cit.* p. 112, pl. xi. figs. 8, 9.

1883. *Sandalodus complanatus*, St. John & Worthen, Pal. Illinois, vol. vii. p. 184, pl. xii. figs. 1, 2, (? figs. 3, 4).

Type. (?) "Upper" dental plate.

"Upper" dental plate having the antero-lateral margin about equal in length to the inner margin; two rounded coronal ridges from the outer to the inner side irregularly connected in the middle. "Lower" dental plate subtriangular, with the postero-lateral border much longer than either of the others, which are about equal; coronal surface raised anteriorly, though with a narrow antero-lateral "wing."

Form. & Loc. Burlington Limestone (Lower Carboniferous): Illinois.

P. 2451. Imperfect "lower" dental plate; Quincy, Illinois.
Enniskillen Coll.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Sandalodus convexus: *Orthoplenrodus convexus*, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 193, pl. xiii. figs. 4, 5.—Coal-Measures (above Mahoning Sandstone); West Virginia.

Sandalodus novo-mexicanus: *Orthoplenrodus novo-mexicanus*, St. John & Worthen, *op. cit.* vol. vii. p. 195, pl. xiii. figs. 1–3.—Lower Carboniferous; Santa Fé, New Mexico.

Sandalodus parvulus, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 102, pl. x. fig. 1: *Stenopterodus parvulus* (in part), St. John & Worthen, *op. cit.* vol. vii. p. 107, pl. iv. figs. 4–8.—St. Louis Limestone; Illinois, Missouri, and Iowa. [Type species.]

Sandalodus robustus, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 62, pl. v. fig. 7.—Lower Carboniferous Limestone; Belgium.

Sandalodus spatulatus, Newberry & Worthen, *op. cit.* vol. ii. p. 103, pl. x. fig. 2; and St. John & Worthen, *op. cit.* vol. vii. p. 188, pl. xii. fig. 7: *Deltodus rhomboideus*, Newberry & Worthen, *op. cit.* vol. ii. p. 100, pl. ix. fig 8: *Sandalodus crassus*, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 369, pl. iv. fig. 3.—St. Louis Limestone; Illinois and Missouri. [Synonymy given by St. John & Worthen, *loc. cit.*]

Sandalodus tenerrimus: *Streblodus tenerrimus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 55, pl. vi. fig. 13: *Vaticinodus tenerrimus*, St. John & Worthen, *op. cit.* vol. vii. p. 81.—Lower Carboniferous Limestone; Tournai, Belgium.

Sandalodus vetustus: *Vaticinodus vetustus*, St. John & Worthen, *op. cit.* vol. vii. p. 82, pl. iii. fig. 1.—Kinderhook Limestone; Iowa.

According to Trautschold (Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. 1879, p. 57), teeth of *Sandalodus* also occur in the Carboniferous Limestone of Mjatschkowa, Moscow.

A number of imperfect, mostly indeterminable, Cochliodont teeth from the Carboniferous of the United States, have been described under the names of *Vaticinodus discrepans*, St. John & Worthen (*op. cit.* vol. vii. p. 83, pl. iii. figs. 2, 3), *V.* (?) *carbonarius*, St. J. & W.

(*ibid.* p. 88, pl. iv. fig. 20), *V.* (?) *lepis*, St. J. & W. (*ibid.* p. 88, pl. iv. fig. 21), *V.* (?) *similis*, St. J. & W. (*ibid.* p. 86, pl. iv. figs. 17–19), and *V.* (?) *simplex*, St. J. & W. (*ibid.* p. 84, pl. iv. figs. 22–26). The last-named "species" comprises a triangular tooth.

Closely related to *Sandalodus* is the genus and species *Platyodus lineatus*, J. S. Newberry (Rep. Geol. Surv. Ohio, vol. ii. pt. ii. (1875), p. 58, pl. lix. fig. 12), founded upon a tooth from the Waverly Shales of Kentucky.

Genus **TOMODUS**, Davis (*ex* Agassiz, MS.).

[Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 446.]

Dental plates thick, massive, triangular in outline, gently arched, and the outer apex strongly inrolled; coronal surface smooth, punctate. One lateral margin—apparently the antero-lateral—straight, presenting an abrupt face with a sharp angulation above; the crown at the opposite margin becoming thinner, with an extension of the root beyond; inner margin gently curved, making a right angle with the antero-lateral margin.

Before the definition of this "genus," the name *Tomodus* had already been proposed by Trautschold[1] for a narrow high-crowned tooth from the Carboniferous Limestone of Russia (see p. 229). Since, however, the term is in each case provisional, and as Trautschold has more recently[2] renamed the Russian tooth *Oxytomodus*, it does not appear advisable to alter the accepted name of the teeth described below.

Tomodus convexus, Davis.

1838. *Cochliodus contortus*, L. Agassiz (in part), Poiss. Foss. vol. iii. p. 115, pl. xiv. figs. 23–25.
1862. *Tomodus convexus*, Morris & Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).
1883. *Tomodus convexus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 446, pl. lv. figs. 15–18.
1883. *Tomodus convexus*, St. John & Worthen, Pal. Illinois, vol. vii. p. 172.

Type. Detached dental plates; Bristol Museum.

The type species. Dental plates (according to Davis) of two kinds, larger and smaller. The large plate convex in each direction, the coronal surface without ridges and furrows; maximum distance

[1] Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 55.
[2] Bull. Soc. Imp. Nat. Moscou, 1880, pt. ii.

from the outer apex to the inner margin about 0·035. Small plate relatively narrower, the lateral margins of the crown more or less raised, with a median hollow; maximum distance from the outer apex to the inner margin about 0·018.

Form. & Loc. Lower Carboniferous Limestone: Bristol.

20575, 36198, 41162. Thirteen large dental plates.
Purchased, 1846, 1861, 1868.

39169. Abraded large dental plate, with a fragment, either of cartilage or of the root of a smaller tooth, attached posteriorly. *Bowerbank Coll.*

P. 1403. Twelve large dental plates, some showing indications of wear in the middle of the crown. *Egerton Coll.*

P. 2492. Four large examples and five of the small variety.
Enniskillen Coll.

20575 a, 20828, 41169. Six small dental plates.
Purchased, 1846, 1847, 1868.

No other undoubted species of *Tomodus* is yet known. The dental plates from the Belgian Lower Carboniferous Limestone, described by L. G. de Koninck under the names of *Tomodus craigi*[1] and *T. laciniatus*[2], may be referred respectively to *Psephodus* and *Pleuroplax*. Another supposed species from the Burlington Limestone (Lower Carboniferous) of Iowa, U.S.A., is also uncertain, namely *Tomodus? limitaris*, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 173, pl. xiii. fig. 12.

Genus **XYSTRODUS**, Agassiz.

[Morris & Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. 1862, p. 101[3].]

Dental plates small, thin, delicate, triangular in outline, gently arched, with the outer apex more or less inrolled; coronal surface exhibiting the punctations closely arranged in transverse parallel rows, generally producing a definite striated appearance. Antero-lateral portion of the crown much raised, and thicker than the postero-lateral, which is also slightly upturned at the margin.

[1] Faune Calc. Carbf. Belg. pt. i. 1878, p. 61, pl. iv. fig. 8, pl. vi. figs. 18, 19.
[2] *Op. cit.* pt. i. p. 61, pl. vi. fig. 20.
[3] The name only is here mentioned and applied to the species previously described and figured by M'Coy under the name of *Cochliodus striatus*. The type species being thus already well-defined in 1862, the generic name may be regarded as dating from that year.

As already remarked by St. John and Worthen [1], the known dental plates of each species are of two forms—the one, presumably pertaining to the upper jaw, but little inrolled and very narrow antero-posteriorly, the other considerably inrolled and of the reverse proportions.

So far as known, *Xystrodus* may be regarded as closely allied to *Tomodus*, the dental plates only differing from the small plates of the latter genus in their less curvature and in the peculiar arrangement of the minute coronal punctations.

Xystrodus striatus (M'Coy).

1843. *Cochliodus striatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).

1855. *Cochliodus striatus*, F. M'Coy, Brit. Palæoz. Foss. p. 624, pl. 3 I. fig. 27.

1862. *Xystrodus striatus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1862. *Xystrodus angustus*, Morris & Roberts, *tom. cit.* p. 101 (name only).

1883. *Xystrodus striatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 448, pl. liv. figs. 7–10.

1883. *Xystrodus angustus*, J. W. Davis, *tom. cit.* p. 449, pl. lv. figs. 19–21.

1883. *Xystrodus striatus*, St. John & Worthen, Pal. Illinois, vol. vii. p. 183.

Type. "Upper" dental plate; Woodwardian Museum, Cambridge.

Transverse striæ upon the coronal surface very prominent and regular in unabraded specimens. "Upper" dental plate regularly triangular, the inner margin of the adult having an average measurement of about 0·01, the distance from the outer apex to the inner margin being about 0·022. Angle between the postero-lateral and inner borders of the "lower" dental plate very acute, and much elevated; antero-lateral border also much raised, giving the plate a twisted appearance; measurements of a typical specimen—postero-lateral margin 0·018, inner margin 0·012.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland; Northumberland, England. Upper Carboniferous Limestone: Ayrshire, Scotland; Derbyshire, England.

(i.) "*Upper*" *dental plates.*

P. 2467–9. Three specimens figured by J. W. Davis, *loc. cit.*, under the name of *X. angustus*; Armagh. *Enniskillen Coll.*

P. 2475. Twelve similar dental plates; Armagh. *Enniskillen Coll.*

[1] Pal. Illinois, vol. vii. p. 175.

P. 1446. Four imperfect specimens ; Armagh. *Egerton Coll.*

46042. Large abraded specimen ; Beith, Ayrshire.
Presented by Robert Craig, Esq., 1874.

P. 5354. Five fragments of abraded dental plates detached from the matrix, one being shown in Pl. I. fig. 22 ; Ticknall, near Melbourne, S. Derbyshire. *Wilson Coll.*

(ii.) "*Lower*" *dental plates.*

P. 2471–4. Four specimens figured by J. W. Davis, *loc. cit.*, under the name of *X. striatus* ; Armagh. *Enniskillen Coll.*

P. 2475 a. Six similar specimens ; Armagh. *Enniskillen Coll.*

P. 1446 a. One dental plate ; Armagh. *Egerton Coll.*

Xystrodus verus, St. John & Worthen.

1883. *Xystrodus verus*, St. John & Worthen, Pal. Illinois, vol. vii. p. 181, pl. viii. figs. 6, 7.

Type. Detached dental plates.

Transverse striæ upon the coronal surface large, irregular and wavy, coalescing and bifurcating. "Upper" dental plates regularly triangular, the inner margin of the adult having an average measurement of about 0·009, the distance from the outer apex to the inner margin being about 0·02 ; anterior coronal elevation prominent and the antero-lateral border abruptly descending almost vertically from its summit.

Form. & Loc. Chester Limestone (Lower Carboniferous) : Illinois, U.S.A.

P. 2479. Two "upper" dental plates detached from matrix : horizon unrecorded, but probably from the Chester Limestone.
Enniskillen Coll.

Xystrodus (?) egertoni, Davis.

1883. *Xystrodus egertoni*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 450, pl. lv. figs. 22, 23.

Type. Abraded dental plates ; British Museum.

Founded upon comparatively massive, abraded dental plates, with an irregular coronal surface, exhibiting little concavity, and large punctations only indistinctly arranged in transverse rows. More

satisfactory specimens are required to render it certain that the species does not pertain to *Tomodus*.

Form. & Loc. Lower Carboniferous Limestone: Bristol.

P. 2476–7. Type specimens. *Enniskillen Coll.*

P. 2478. A similar, but smaller dental plate. *Enniskillen Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection :—

Xystrodus alatus, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 64, pl. v. fig. 9.—Upper Carboniferous Limestone; Visé, Belgium.

Xystrodus bellulus, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 183, pl. viii. fig. 3.—Lower Coal Measures; Illinois.

Xystrodus imitatus, St. John & Worthen, *tom. cit.* p. 180, pl. viii. fig. 2.—St. Louis Limestone; Missouri, Illinois, and Iowa.

Xystrodus inconditus, St. John & Worthen, *tom. cit.* p. 179, pl. viii. fig. 1.—Keokuk Limestone; Illinois and Iowa.

(?) *Xystrodus* (?) *occidentalis*, O. St. John, Proc. Amer. Phil. Soc. 1870, p. 436, and in Hayden's Final Rep. Geol. Surv. Nebraska, 1872, p. 244, pl. iv. fig. 18.—Upper Coal Measures; Nebraska.

Xystrodus parkeri, J. W. Davis, Geol. Mag. [3] vol. iii. (1886), p. 153, figs. 3, 4.—Carboniferous Limestone; Derbyshire.

Xystrodus simplex, St. John & Worthen, *tom. cit.* p. 178, pl. viii. figs. 4, 5.—Upper Burlington Limestone; Iowa and Illinois.

Genus **DELTODUS**, Agassiz.

[Morris & Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. 1862, p. 100[1].]

Syn. *Tæniodus*, St. John & Worthen, Pal. Illinois, vol. vii. 1883, p. 75 (in part).

Two posterior series of teeth represented by two separate triangular dental plates, marked by numerous rounded transverse ridges and furrows parallel to the inner border; antero- and postero-lateral borders usually longer than the inner border, not indented. In each dental plate the large ridge from the outer to the inner

[1] The name only is here mentioned and applied to the species previously described and figured by M'Coy, under the name of *Pœcilodus sublævis*. The type species being thus already well-defined in 1862, the generic name may be regarded as dating from that year.

border is broad, rounded, and placed nearest the antero-lateral margin.

The dental plates of one jaw (presumably the lower) are much more inrolled than those of the opposing jaw.

Deltodus sublævis (M'Coy).

1843. *Pœcilodus sublævis*, L. Agassiz, Rech. Poiss. Foss. vol. iii. p. 174 (name only).

1843. *Pœcilodus parallelus*, L. Agassiz, *tom. cit.* p. 174 (name only).

1855. *Pœcilodus sublævis*, F. M'Coy, Brit. Palæoz. Foss. p. 640, pl. 31. figs. 7, 8, 9.

1855. *Pœcilodus parallelus*, F. M'Coy, *op. cit.* p. 640, pl. 31. fig. 6.

1862. *Deltodus sublævis*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).

1883. *Deltodus sublævis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 428, pl. lii. figs. 7–9.

1883. *Deltodus expansus*, J. W. Davis, *tom. cit.* p. 431, pl. liii. fig. 11.

1883. *Pœcilodus jonesii*, J. W. Davis, *tom. cit.* p. 142, pl. liii. fig. 22.

Type. Detached dental plates: Woodwardian Museum, Cambridge.

A comparatively small species, the maximum transverse measurement of the supposed lower posterior dental plates being about 0·02. Transverse ridges and furrows of the dental crown numerous, rounded, and very prominent in unabraded specimens. The prominent elevation extending from the outer to the inner margin is gently rounded, gradually passes into the narrower postero-lateral flattened portion of the plate, and immediately adjoins the antero-lateral margin; inner margin gently undulating.

D. expansus, Davis, appears to be founded upon a crushed abraded "lower" dental plate of this species.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

(i.) *Slightly curved variety of posterior dental plate (? upper jaw).*

P. 2442–3. Two plates described and figured by J. W. Davis, *loc. cit.* p. 428, pl. lii. figs. 7, 8. *Enniskillen Coll.*

P. 2444. Twenty specimens variously abraded. *Enniskillen Coll.*

P. 1450–1. Eight similar specimens. *Egerton Coll.*

(ii.) *Narrow dental plates placed in advance of the posterior dental plates, the more incurved examples referable to the "lower" jaw, the others probably to the "upper."*

P. 2445 a. Fourteen specimens. *Enniskillen Coll.*

P. 2459. Abraded example, described and figured by J. W. Davis, *loc. cit.*, as an anterior tooth of *Pœcilodus jonesii*.
Enniskillen Coll.

P. 1449. Three similar teeth. *Egerton Coll.*

(iii.) *Inrolled variety of posterior dental plates* (*? lower jaw*).

P. 2441. Specimen with the narrow anteriorly-placed plate in its natural position, described and figured by J. W. Davis, *loc. cit.* p. 430, pl. lii. fig. 9. *Enniskillen Coll.*

P. 2445–6. Twenty-five variously abraded plates.
Enniskillen Coll.

P. 2447. Much abraded and crushed dental plate, the type specimen of *D. expansus*, Davis, *loc. cit.* *Enniskillen Coll.*

P. 1447–8. Seven specimens. *Egerton Coll.*

Deltodus gibbus, sp. nov.

Type. "Lower" dental plates, shown in Pl. VI. figs. 19, 20.

A comparatively small species, the maximum transverse measurement of the supposed lower posterior dental plate being about 0·014. Anterior coronal elevation extending from the outer to the inner margin, broad, rounded, but having a hump-backed appearance when worn, gradually passing into the narrow postero-lateral flattened portion of the plate, and immediately adjoining the antero-lateral margin; inner margin strongly curved throughout the greater portion of its length, the rounded elevation projecting. Transverse ridges and furrows of the dental crown narrow, feebly marked.

The opposing dental plates of this species are not yet certainly recognizable: it seems likely that they are confounded with the supposed upper dental plates of *Deltoptychius gibberulus*.

Form. & Loc. Lower Carboniferous Limestone: Bristol.

20575 b, P. 5859. Type specimens, readily distinguished from the corresponding dental plates of *D. sublævis* by their narrowness and the prominence, obliquity, and sharply-bent worn surface of the rounded coronal elevation.
Purchased, 1846, and *History unknown.*

P. 5860. Similar specimen. *History unknown.*

34980. More imperfect abraded dental plate. *Purchased*, 1860.

Deltodus rugosus, sp. nov.

Type. Upper and lower dental plates, shown in Pl. VI. figs. 21, 22.

A very small species, the maximum transverse measurement of the supposed lower posterior dental plate being about 0·011. Transverse ridges and furrows of the dental crown fine, not always continuous, more or less wavy. Posterior "lower" dental plate notably elongated in an antero-posterior direction, the gently rounded coronal elevation extending from the outer to the inner margin not immediately adjoining the antero-lateral border.

Form. & Loc. Carboniferous Limestone: Shropshire.

42186, 36193. Type specimens shown, of twice the natural size, in Pl. VI. figs. 21, 22, the first being an "upper" dental plate, the second a "lower"; Oreton.
Baugh Coll., and *Purchased*, 1861.

42186 a. Imperfect "upper" dental plate; Oreton. *Baugh Coll.*

42186 b, 42225. Four imperfect "lower" dental plates; Oreton.
Baugh Coll.

Deltodus concha (Trautschold).

1874. *Pœcilodus concha*, H. Trautschold, Mém. Soc. Imp. Nat. Moscou, vol. xiii. p. 290, pl. xxviii. fig. 6, pl. xxix. fig. 10.
1874. *Pœcilodus limbatus*, H. Trautschold, *tom. cit.* p. 290, pl. xxviii. fig. 7.

Type. Detached tooth.

A comparatively small species, the maximum transverse measurement of the supposed lower posterior dental plate being about 0·016. Transverse ridges and furrows of the dental crown few, large, rounded. Posterior "lower" dental plate ("*Pœcilodus limbatus*") slightly elongated antero-posteriorly, the prominent elevation extending from the outer to the inner margin very broad, gently rounded, immediately adjoining the antero-lateral margin. Anterior "lower" dental plate ("*Pœcilodus concha*") rapidly widening inwardly.

Form. & Loc. Carboniferous Limestone: Government of Moscow, Russia.

P. 5115. Three anterior dental plates; Mjatschkowa.
Purchased, 1886.

Deltodus occidentalis (Leidy).

1857. *Cochliodus occidentalis*, J. Leidy, Trans. Amer. Phil. Soc. [2] vol. xi. p. 88, pl. v. figs. 3–16.

1866. *Deltodus stellatus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 97, pl. ix. figs. 2, 3.

1883. *Deltodus occidentalis?*, St. John & Worthen, *op. cit.* vol. vii. p. 150, pl. ix. figs. 9, 10.

Type. Detached dental plates.

Transverse coronal folds, when present, broad and faintly marked, but generally absent. "Lower" posterior dental plate obliquely twisted, gently arched, with the outer apex closely inrolled: anterior coronal elevation extending from the outer to the inner margin broad, unequally divided by a faint angulation along its highest part.

St. John and Worthen describe the supposed lower median dental plate and the upper posterior dental plate of this species.

Form. & Loc. St. Louis, Warsaw, and Keokuk Limestones (Lower Carboniferous): Illinois, U.S.A.

P. 2453. Two abraded examples: Keokuk Limestone, Warsaw, Illinois. *Enniskillen Coll.*

Deltodus spatulatus, Newberry & Worthen.

1866. *Deltodus spatulatus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 100, pl. ix. fig. 7.

1879. *Deltodus spatulatus*, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78, p. 346.

Type. (?) "Upper" dental plates.

Supposed upper dental plate obliquely spatulate in outline, the broader end having rounded angles: anterior long coronal prominence gently angulated; unabraded coronal surface with only faint transverse parallel furrows.

Form. & Loc. Burlington and Keokuk Limestones (Lower Carboniferous): Illinois and Indiana, U.S.A.

P. 2452. Two imperfect specimens: Burlington Limestone, Quincy, Illinois. *Enniskillen Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Deltodus alatus, Newberry & Worthen, Pal. Illinois, vol. iv. (1870), p. 368, pl. ii. fig. 6.—Keokuk Limestone; Illinois.

Deltodus aliformis, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 431, pl. liii. fig. 12: *Pœcilodus aliformis*,

F. M'Coy, Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 129; and Brit. Paleoz. Foss. 1855, p. 638, pl. 3*a*. fig. 10.—Upper Carboniferous Limestone; Derbyshire.

Deltodus angustus, Newberry & Worthen, *op. cit.* vol. iv. p. 368, pl. iii. fig. 7: *Deltodopsis angustus*, St. John & Worthen, Pal. Illinois, vol. vii. pp. 160, 163, pl. xi. figs. 7–10.—Chester Limestone; Illinois.

Deltodus cinctulus, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 146, pl. ix. figs. 6, 7.—Warsaw Limestone; Missouri and Illinois.

Deltodus cinctus, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876-78 (1879), p. 344.—St. Louis Limestone; Indiana.

Deltodus cingulatus, Newberry & Worthen, *op. cit.* vol. ii. p. 99, pl. ix. fig. 6.—Chester Limestone; Illinois.

Deltodus circinans: *Poecilodus circinans*, H. Trautschold, Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 52, pl. vii. fig. 1.—Carboniferous Limestone; Government of Moscow.

(?) *Deltodus contortus*: *Tæniodus contortus*, St. John & Worthen (*ex* L. G. de Koninck, MS.), *op. cit.* vol. vii. (1883), p. 76.—Lower Carboniferous Limestone; Visé, Belgium.

(?) *Deltodus fasciatus*, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 366, pl. iii. fig. 17: *Tæniodus fa*[*s*]*ciatus*?, St. John & Worthen, *op. cit.* vol. vii. (1883), p. 76, pl. xiii. fig. 9.—Keokuk Limestone; Illinois.

Deltodus grandis: *Poecilodus grandis*, H. Trautschold, *loc. cit.* vol. xiv. (1879), p. 51, pl. vi. fig. 13.—Carboniferous Limestone; Government of Moscow.

Deltodus incrassatus, H. Trautschold, *loc. cit.* vol. xiv. p. 54, pl. vii. fig. 5.—Carboniferous Limestone; Government of Moscow.

Deltodus intermedius, St. John & Worthen, *op. cit.* vol. vii. p. 153, pl. ix. figs. 14, 15.—St. Louis Limestone; Iowa, Illinois.

(?) *Deltodus laminaris*, H. Trautschold, *loc. cit.* vol. xiv. (1879), pl. vii. fig. 6: *Cochliodus laminaris*, H. Trautschold, *loc. cit.* vol. xiii. (1874), p. 291.—Carboniferous Limestone; Government of Moscow.

Deltodus latior, St. John & Worthen, *op. cit.* vol. vii. p. 145, pl. ix. figs. 11, 12.—Keokuk Limestone; Illinois and Iowa.

Deltodus littoni, Newberry & Worthen, *op. cit.* vol. iv. p. 367, pl. iv. fig. 8; and St. John & Worthen, *op. cit.* vol. vii. p. 149.—Lower Carboniferous; Missouri.

Deltodus mercurei, J. S. Newberry, in Rep. Expl. Exped. from Santa Fé, New Mexico, to Colorado, 1876, p. 137, pl. iii. fig. 1;

also St. John & Worthen, *op. cit.* vol. vii. pl. x. fig. 2.—Coal Measures; Santa Fé, New Mexico.

Deltodus obliquus: *Taniodus obliquus*, St. John & Worthen, *op. cit.* vol. vii. p. 78, pl. xiii. fig. 10.—Chester Limestone; Illinois.

Deltodus ornatus: *Poecilodus ornatus*, Newberry & Worthen, *op. cit.* vol. ii. (1866), p. 95, pl. viii. fig. 14.—Keokuk Limestone; Illinois.

Deltodus parvus, St. John & Worthen, *op. cit.* vol. vii. p. 151, pl. ix. figs. 1–5.—St. Louis Limestone; Iowa, Illinois, and Missouri.

Deltodus powellii, St. John & Worthen, *op. cit.* vol. vii. p. 154, pl. x. fig. 1.—Carboniferous Limestone (? Coal Measures); Utah.

Deltodus propinquus, St. John & Worthen, *op. cit.* vol. vii. p. 156, pl. x. figs. 3, 4.—Coal Measures; Illinois.

Deltodus rossicus: *Poecilodus rossicus*, A. von Keyserling, Reise in das Petschoraland (1846), p. 292, pl. xxi. fig. 6.—Carboniferous; Kabosha.

Deltodus sandalinus, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 63, pl. v. fig. 8.—Upper Carboniferous Limestone; Visé, Belgium.

(?) *Deltodus triangularis*, H. Trautschold, *loc. cit.* vol. xiv. pl. vii. fig. 7: *Cochliodus triangularis*, H. Trautschold, *loc. cit.* vol. xiii. (1874), p. 292.—Carboniferous Limestone; Government of Moscow.

Deltodus trilobus, St. John & Worthen, *op. cit.* vol. vii. p. 148, pl. ix. fig. 8.—Warsaw Limestone; Illinois.

Deltodus undulatus, Newberry & Worthen, *op. cit.* vol. ii. p. 98, pl. ix. fig. 5.—Keokuk Limestone; Iowa[1].

The so-called *Helodus*(?) *curvatus*, L. G. de Koninck (Faune Calc. Carbf. Belg. pt. i. 1878, p. 40, pl. iv. fig. 15), from the Carboniferous Limestone of Belgium, is probably referable to *Deltodus*.

Genus **PŒCILODUS**, M'Coy (emend. A. S. W.).

[Brit. Palæoz. Foss. 1855, p. 638, in part.]

Two posterior series of teeth in each jaw represented by a single much inrolled plate, generally antero-posteriorly elongated; coronal surface marked by more or less distinct transverse ridges and furrows. Two prominent broadening ridges extend from the outer margin to the inner, the posterior of these being much the largest.

[1] Possibly to this species may be referred a fragmentary fossil from Warsaw, Illinois (**P. 2455**, *Enniskillen Coll.*).

There is yet no evidence of any fusion of the teeth in advance of the great posterior plate; and the narrow specimen described by J. W. Davis[1] as the "anterior tooth" of *Pœcilodus jonesii* is the foremost of the two dental plates of *Deltodus sublævis*, being thus homologous with the anterior ridge upon the single dental plate of *Pœcilodus*.

As remarked below (p. 212), St. John and Worthen regard the dental plates, assigned in England to the lower jaw of *Deltoptychius*, as truly the lower dental plates of *Pœcilodus*. It seems, however, much more probable that the dentition of each jaw of *Pœcilodus* was transversely ribbed, and this provisional interpretation is here adopted. Of each of the well-marked British and Irish species there are two forms of dental plates—one with the ridges from the outer to the inner margin rounded, the other with these ridges angulated. The former most probably pertain to the one jaw, the latter to the opposite.

Pœcilodus jonesii (M'Coy).

1843. *Pœcilodus jonesii*, *P. obliquus*, and *P. transversus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (names only).
1843. *Pœcilodus jonesii*, J. E. Portlock, Rep. Geol. Londonderry, p. 468, pl. xiv. *a*. fig. 6 (name and fig. only).
1843. *Pœcilodus transversus*, J. E. Portlock, *op. cit.* p. 468, pl. xiv. *a*. fig. 7 (name and fig. only).
1855. *Pœcilodus jonesii*, F. M'Coy, Brit. Palæoz. Foss. p. 639.
1855. *Pœcilodus obliquus*, F. M'Coy, *op. cit.* p. 640, pl. 3 I. fig. 5.
1883. *Pœcilodus jonesii*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol i. p. 442, pl. liii. figs. 20, 21, 23 (*non* fig. 22).
1883. *Pœcilodus obliquus*, J. W. Davis, *tom. cit.* p. 443, pl. liii. fig. 24.
1883. *Pœcilodus corrugatus*, J. W. Davis, *tom. cit.* p. 444, pl. liii. fig. 25.
1884. *Pœcilodus corrugatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 625, pl. xxvii. fig. 21.
1886. *Pœcilodus jonesii*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 152.

Type. Detached dental plates.

Dental plate much elongated antero-posteriorly; coronal corrugations numerous, continuous, and prominent in unworn specimens; diverging ridges comparatively low; inner margin slightly sinuous.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland; Ayrshire, Scotland. Upper Carboniferous Limestone: Northumberland, Yorkshire, and Derbyshire.

[1] Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 442, pl. liii. fig. 22.

(i.) *Rounded variety (? upper jaw).*

P. 2457–8, P. 2460. Three dental plates, described and figured by J. W. Davis, *loc. cit.* 1883, as *P. jonesii*; Armagh. *Enniskillen Coll.*

P. 2456. Thirty similar plates; Armagh. *Enniskillen Coll.*

P. 1412. Ten examples; Armagh. *Egerton Coll.*

P. 2456 a. Impression of a dental plate, of which only the anterior part is preserved; Armagh. This is the type specimen of *P. transversus*, Agassiz MS., and bears the following labels.—"This specimen convinces me that Mons. Agassiz's species *Pœcilodus transversus* is a bad one. I consider it to be a divided tooth of *Pœcilodus Jonesii*. [Signed] Enniskillen, Florence Court, Feb. 4th, 1858."—"I was certainly mistaken in distinguishing a *Pœcilodus transversus* as distinct from *P. Jonesii*. [Signed] Agass." *Enniskillen Coll.*

28738. Seven dental plates; Armagh. *Purchased*, 1853.

26039, 28741. Six fragments of dental plates similar to those from Yorkshire described as *P. corrugatus*, Davis; Armagh. *Purchased*, 1851, 1853.

46038. Typical dental plate; Beith, Ayrshire. *Presented by Robert Craig, Esq.*, 1874.

P. 4902. Two fragments; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

49615. Similar fragment; Richmond, Yorkshire. *Purchased*, 1878.

46819. Imperfect dental plate; Derbyshire. *Gilbertson Coll.*

P. 5356. Seven fragments of dental plates, one figured (Pl. I. fig. 25); Ticknall, near Melbourne, S. Derbyshire. *Wilson Coll.*

P. 5355 a. Small imperfect example; Ticknall. *Wilson Coll.*

(ii.) *Angulated variety (? lower jaw).*

P. 2461. Dental plate described and figured by J. W. Davis, *loc. cit.* 1883, as *P. obliquus*; Armagh. *Enniskillen Coll.*

P. 2462. Thirty dental plates, some much abraded; Armagh. *Enniskillen Coll.*

P. 1413. Seven imperfect examples; Armagh. *Egerton Coll.*

46818. Small specimen; Derbyshire. *Gilbertson Coll.*

P. 5355. Ten fragmentary small dental plates; Ticknall, S. Derbyshire. The two most nearly perfect specimens are shown of the natural size in Pl. I. figs. 23, 24. *Wilson Coll.*

Pœcilodus gibbosus, Davis.

1883. *Pœcilodus gibbosus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 445, pl. liii. fig. 27.

Type. Detached dental plate; British Museum.

Maximum antero-posterior diameter of the dental plate not much greater than its breadth; coronal corrugations numerous, continuous. Anterior diverging ridge small, the posterior very prominent, though not affecting the extreme postero-lateral margin; inner margin deeply sinuous.

Form. & Loc. Lower Carboniferous Limestone: Armagh and Sligo, Ireland.

(i.) *Rounded variety* (*? upper jaw*).

P. 2463-4. Type specimen, and two similar dental plates; Armagh. *Enniskillen Coll.*

P. 2464 a. A smaller dental plate, probably of this species: Armagh. *Enniskillen Coll.*

(ii.) *Angulated variety* (*? lower jaw*).

P. 2465. Nearly complete tooth, shown, of the natural size, in Pl. VI. fig. 23; Callooney, Sligo. *Enniskillen Coll.*

An undetermined species, possibly of *Pœcilodus*, is indicated by the following tooth, which exhibits no ridges extending from the outer to the inner border:—

42231. Tooth measuring 0·013 by 0·007, the transverse rugæ few and irregular; Carboniferous Limestone: Oreton, Shropshire. *Baugh Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Pœcilodus carbonarius, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 139, pl. viii. figs. 20, 21.—Upper Coal Measures; Illinois and Kansas, U.S.A.

Pœcilodus cestriensis, St. John & Worthen, *tom. cit.* p. 135, pl. viii. figs. 15–17.—Chester Limestone; Illinois.

(?) *Pœcilodus paradoxus*, W. Waagen, Pal. Ind. ser. 13, pt. i. (1879), p. 12, pl. i. fig. 1.—Productus Limestone; Salt Range, India.

Pœcilodus rugosus, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 94, pl. viii. fig. 13.—Keokuk Limestone; Illinois.

Pœcilodus sancti-ludovici, St. John & Worthen, *tom. cit.* p. 132, pl. viii. figs. 11, 12 (? figs. 8–10).—St. Louis Limestone; Missouri, Illinois, and Iowa.

Pœcilodus carsonvicnsis, St. John & Worthen, *tom. cit.* p. 131, pl. viii. figs. 13, 14.—Warsaw Limestone; Illinois.

The so-called *P. springeri* (St. John & Worthen, *tom. cit.* p. 138, pl. viii. fig. 19), from the Lower Carboniferous Limestone of Santa Fé, New Mexico, and *P. vorthoni* (St. John, *tom. cit.* p. 136, pl. viii. fig. 18), from the Chester Limestone of Illinois, are founded upon teeth which would, in Europe, be regarded as referable to *Deltoptychius*.

The tooth from the Belgian Carboniferous Limestone named *Pœcilodus*(?) *elegans* by L. G. de Koninck (Faune Calc. Carbf. Belg. pt. i. p. 59, pl. vi. fig. 17) is generically indeterminable. The Russian Carboniferous teeth named *P. lingulatus* and *P. sulcatus* by H. Romanowsky (Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 164, pl. iv. figs. 28, 29) are extremely doubtful fragments, and may even pertain to *Janassa*. The same remark applies to *P. convolutus*, Newberry & Worthen (Pal. Illinois, vol. iv. 1870, p. 366, pl. ii. fig. 9), from the Keokuk Limestone of Illinois.

Genus **COCHLIODUS**, Agassiz.

[Poiss. Foss. vol. iii. 1838, p. 113.]

Two posterior series of teeth in the "lower" jaw represented by two separate dental plates, having the outer border much inrolled. Posterior dental plate elongated antero-posteriorly; postero-lateral and antero-lateral borders rapidly converging outwards, the second almost at right angles to the long axis of the supporting cartilage; coronal contour raised by a median rounded ridge, extending from the outer to the inner border. Anterior dental plate very narrow, the hinder portion of the crown raised into a high, obtusely-angulated ridge, extending from the outer to the inner border. Coronal surface without transverse corrugations. Symphysial teeth small and feebly prehensile.

Owen[1] has stated that there is evidence of a third smaller dental plate in advance of those just described; but the original specimen supposed to prove this circumstance merely shows the remains of bases of teeth in the position indicated, and more recent discoveries render it probable that there was no such triangular plate, but rather a series of small *Helodus*-like teeth.

Cochliodus contortus, Agassiz.

1838. *Cochliodus contortus*, L. Agassiz, Poiss. Foss. vol. iii. p. 115, pl. xix. fig. 14 (*non* pl. xiv. figs. 16–33).
1840. *Cochliodus contortus*, R. Owen, Odontography, vol. i. p. 62, vol. ii. p. 10, pl. xxii. fig. 1.
1855. *Cochliodus contortus*, F. M'Coy, Brit. Palæoz. Foss. p. 622.
1856. *Cochliodus contortus*, F. Roemer, in Bronn's Leth. geogn. vol. i. p. 708, pl. ix. *b*. fig. 4.
1867. *Cochliodus contortus*, R. Owen, Geol. Mag. vol. iv. p. 59, pl. iii. figs. 1, 3, 4, 5.
1867. *Tomodus convexus*, R. Owen, *tom. cit.* p. 62, pl. iv. figs. 2–5.
1878. *Cochliodus contortus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. p. 57, pl. vi. fig. 14.
1883. *Cochliodus contortus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 421, pl. lii. figs. 1–6.

Type. Dental plates in natural position upon the jaw; British Museum.

The type species. Dental plates very variable in form, the proportions of the antero-lateral and postero-lateral areas of the posterior plate on each side of the ridge especially inconstant. Large ridge gently rounded, oblique, attaining the inner margin, where it is broadest; coronal surface smooth.

None of the dental plates from Bristol assigned by Agassiz (*tom. cit.* pl. xiv. figs. 16–33) to this species can be correctly retained in this position. The specimens described by Owen were from Armagh, not from Bristol, as stated. Some Russian teeth, also ascribed to *Cochliodus contortus* by Romanowsky (Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 159, pl. iii. figs. 7–10), are very questionably determined.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland; Belgium. Upper Carboniferous Limestone: Yorkshire, England; Belgium.

[1] Geol. Mag. vol. iv. 1867, p. 60.

P. 2424. Type specimen shown, somewhat reduced in size, in the accompanying woodcut (fig. 8); Tynan, Co. Armagh.
Enniskillen Coll.

Fig. 8.

Jaw of *Cochliodus contortus*.—Carboniferous Limestone, Armagh. [P. 2424.]

P. 5849. Plaster cast of specimen described and figured by Owen, *loc. cit.*, under the name of *Tomodus convexus*. The original fossil is much crushed and broken, and is preserved in the Woodwardian Museum, Cambridge; it is correctly determined by J. W. Davis, *loc. cit.* p. 423, and was obtained from Armagh (not Bristol, as stated).
Made in the Museum, 1888.

P. 5850. Plaster cast of specimen described and figured by Owen, *loc. cit.*, under the name of *Cochliodus contortus*.
Made in the Museum, 1888.

P. 2425. Jaw with the posterior dental plates of each side very completely preserved; Armagh. The specimen is figured by J. W. Davis, *loc. cit.* pl. lii. fig. 1. *Enniskillen Coll.*

P. 2426–7. Posterior and anterior dental plates, showing the inrolment of the outer border; Armagh. The specimens are described and figured by J. W. Davis, *loc. cit.* p. 422, pl. lii. figs. 4, 5. *Enniskillen Coll.*

P. 2429. About thirty posterior dental plates, of various sizes and in different states of preservation, some with the anterior tooth attached in position; Armagh. *Enniskillen Coll.*

P. 2428. Sixteen detached anterior dental plates; Armagh.
Enniskillen Coll.

P. 1402. Six small detached posterior plates; Armagh.
Egerton Coll.

P. 4904. Small posterior dental plate shown, of the natural size, in Pl. VI. fig. 24, doubtfully assigned to a variety of this species; Yoredale Rocks, Wensleydale, Yorkshire.
Horne Coll.

Cochliodus latus, Leidy.

1857. *Cochliodus latus*, J. Leidy, Trans. Amer. Phil. Soc. [2] vol. xi. p. 88, pl. v. fig. 17.

1866. *Helodus* (*Cochliodus*) *nobilis*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 89, pl. vii. figs. 1–4, pl. viii. fig. 1.

1886. *Chitonodus latus*, St. John & Worthen, Pal. Illinois, vol. vii. p. 112.

Type. Portion of "lower" dental plate.

A comparatively large species, the posterior "lower" dental plate having an antero-posterior measurement of 0·075. The large ridge of the posterior "lower" plate relatively narrow, with a tendency towards angulation, and not quite attaining the inner margin; coronal surface slightly wrinkled at right angles to the inner margin. Anterior "lower" dental plate with low ridge and feeble plications. Opposing dental plate equal in antero-posterior extent to the two teeth just described, and having the characters of the so-called *Streblodus*.

In the fine specimen described by Newberry and Worthen, *loc. cit.*, there are several scattered series of *Helodus*-shaped teeth in association with the large teeth.

Form. & Loc. Keokuk Limestone (Lower Carboniferous): Illinois, U.S.A.

P. 2430. An almost perfect posterior "lower" tooth: Warsaw. Illinois. *Enniskillen Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Cochliodus costatus, Newberry & Worthen, Pal. Illinois, vol. iv. (1870), p. 364, pl. iii. figs. 10, 12.—Burlington Limestone; Iowa.

Cochliodus leidyi, St. John & Worthen, *op. cit.* vol. vii. (1883), p. 127, pl. vii. figs. 11–16.—Chester Limestone; Illinois. [In this species are also included *Streblodus*-like teeth and anterior Helodont teeth.]

Cochliodus tenuis, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 58, pl. vi. fig. 15.—Lower Carboniferous Limestone; Soignies, Tournai.

Cochliodus van hornii, St. John & Worthen, *op. cit.* vol. vii. p. 120, pl. vii. figs. 1–10.—St. Louis Limestone; Illinois, Missouri, and Iowa. [*Streblodus*-like teeth are hypothetically assigned to the upper jaw, and *Helodus*-like teeth to the more anterior region.]

Genus **STREBLODUS**, Agassiz.

[Morris & Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. 1862, p. 101[1].]

Posterior dental plate much inrolled; antero-lateral border crossing the supporting cartilage at right angles, thus giving the plate a truncated appearance in front; postero-lateral border inclined inwards and backwards, and forming an acute angle with the inner margin. Hinder portion of the coronal surface tumid, and separated more or less abruptly from the less elevated front portion; the latter area often marked by small ridges and grooves proceeding directly from the outer to the inner border.

The dental plate just described is evidently homologous with the single posterior plate of *Psilodus* and *Deltoptychius*, and with the two separate posterior plates of *Cochliodus*. In at least two species (*S. oblongus*, and the so-called upper dental plate of *Deltoptychius wachsmuthi*) the separate *series* of small teeth immediately in advance of this large tooth is known.

By St. John and Worthen the dental plates referred to *Streblodus* are considered to pertain in reality to the genera *Cochliodus*, *Deltoptychius*, and *Chitonodus*. In one case, indeed, plates of this character have been found in natural association with an undoubted jaw of *Cochliodus*[2]; but there is yet no proof of their connection with the two last-named genera, and it thus seems advisable to retain *Streblodus* provisionally independent, awaiting further evidence of the true relationships of the dental fragments on which it has been founded.

Streblodus oblongus (Portlock).

1843. *Cochliodus oblongus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).

1843. *Cochliodus oblongus*, J. E. Portlock, Rep. Geol. Londonderry, p. 466, pl. xiv. *a*. figs. 5, 10.

1855. *Cochliodus oblongus*, F. M'Coy, British Palæoz. Foss. p. 623, pl. 3 H. fig. 19, pl. 3 I. fig. 28.

1862. *Streblodus oblongus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

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[1] The name only is here mentioned and applied to the species previously figured and described by Portlock and M'Coy under the name of *Cochliodus oblongus*. The type species being thus already well-defined in 1862, the generic name may be regarded as dating from that year.

[2] *Cochliodus latus*, Leidy, *suprà*, p. 208.

1867. *Streblodus oblongus*, R. Owen, Geol. Mag. vol. iv. p. 62, pl. iii. fig. 3.

1883. *Streblodus oblongus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 424, pl. liii. figs. 1–4.

Type. Detached dental plate.

Dental plate much elongated antero-posteriorly; hinder tumid portion sharply separated by an abrupt elevation from the anterior portion, with which it is equal in extent; anterior portion crossed by one broad low ridge, and occasional faintly-marked grooves nearly parallel to the antero-lateral margin.

This is supposed to be the upper dental plate of *Cochliodus contortus* by St. John and Worthen[1].

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2417. Portions of two associated dental plates described and figured by Owen, *loc. cit.*, and by J. W. Davis, *tom. cit.* p. 425, pl. liii. fig. 4. *Enniskillen Coll.*

P. 2414. Incomplete dentition, described and figured, and referred to the lower jaw by J. W. Davis, *tom. cit.* p. 424, pl. liii. fig. 1. The two rami are evidently crushed together, and in advance of the large posterior dental plate on each side are indications of the bases of two small series of teeth. Of the first series on the "left" side, one of these small teeth is preserved in position, exhibiting the characters of the so-called genus *Lophodus* or *Helodus*.

Enniskillen Coll.

P. 2415–6. Two posterior dental plates, one exhibiting the inrolment of the outer border; figured by J. W. Davis, *tom. cit.* pl. liii. figs. 2, 3. *Enniskillen Coll.*

P. 2418. Thirty similar specimens. *Enniskillen Coll.*

P. 1400. Twelve specimens, mostly small. *Egerton Coll.*

28727, 28917, 38502, P. 260. Seventeen specimens. *Purchased.*

Streblodus colei, Davis.

1862. *Streblodus colei*, Morris & Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Streblodus colei*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 426, pl. liii. figs. 5, 6.

Type. Detached posterior dental plates; British Museum.

[1] Pal. Illinois, vol. vii. (1883), p. 92.

Dental plate extremely elongated antero-posteriorly: hinder tumid portion passing gradually into the anterior flattened portion; the latter portion longer than the former, and crossed by a small, faint, very oblique ridge.

This is supposed to be the upper dental plate of *Deltoptychius acutus* by St. John and Worthen [1].

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2419–20. Type specimens. *Enniskillen Coll.*

P. 2421. Thirty similar dental plates, the largest having an antero-posterior measurement of 0·053. *Enniskillen Coll.*

P. 1401. Four similar specimens. *Egerton Coll.*

28729. Two imperfect dental plates. *Purchased*, 1853.

A small variety, not distinctly separable from *Streblodus colei* upon present evidence, appears to be indicated by the following specimens:—

P. 4905. Two dental plates, one figured, of the natural size, in Pl. VI. fig. 25; Yoredale Rocks (Upper Carboniferous Limestone), Wensleydale, Yorkshire. *Horne Coll.*

P. 5349. Four portions of dental plates, somewhat larger; Upper Carboniferous Limestone, Ticknall, near Melbourne, S. Derbyshire. *Wilson Coll.*

Streblodus egertoni, Davis.

1862. *Streblodus egertoni*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 101 (name only).

1883. *Streblodus egertoni*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 426, pl. liii. figs. 7, 8.

Type. Detached dental plates; British Museum.

A comparatively small species, the antero-posterior measurement of the largest known dental plate being 0·014. Hinder tumid portion of plate sharply separated by an abrupt elevation from the anterior portion, and about equal to it in extent; anterior portion flattened, only crossed by one small angulated ridge, near to and parallel with the antero-lateral margin.

Form. & Loc. Lower Carboniferous Limestone: Bristol.

P. 2422–3. Type specimens. *Enniskillen Coll.*

20575. Similar dental plate. *Purchased*, 1845.

[1] Pal. Illinois, vol. vii. p. 92.

By St. John and Worthen (Pal. Illinois, vol. vii. 1883), dental plates of the form of *Streblodus* are hypothetically assigned to *Deltoptychius expansus*, *D. primus*, *D. wachsmuthi*, and *D. varsouviensis*, and to various species of *Cochliodus*. *Vaticinodus*, *Stenopterodus*, and *Chitonodus*. Another dental plate forms the type of *Cochliodus obliquus*, St. John and Worthen (*tom. cit.* p. 126, pl. vii. fig. 17) from the St. Louis Limestone of Missouri.

Genus **DELTOPTYCHIUS**, Agassiz.

[Morris & Roberts (*ex* Agassiz, MS.), Quart. Journ. Geol. Soc. vol. xviii. 1862, p. 100 [1].]

Two posterior series of teeth in each jaw represented by a single triangular dental plate, with the coronal surface destitute of transverse ridges and furrows; postero-lateral border much longer than the antero-lateral, and this about equal in length to the inner margin. A large broadening ridge extends from the outer apex to the inner margin; while the postero-lateral border is somewhat raised, and the antero-lateral abruptly ridged, thus giving the plate a twisted appearance.

The dental plates of one jaw (presumably the lower) are much more inrolled than those of the opposing jaw. They are evidently the homologues of the posterior pair of large plates in *Deltodus* and *Cochliodus*; and appearances are suggestive of there having been no fusion of the teeth immediately in front into a second smaller plate.

By St. John and Worthen [2] the dental plates here assigned to the lower jaw of *Deltoptychius* are considered as referable to *Poecilodus*, while the "upper" plates are regarded as truly pertaining to the lower jaw of the genus under consideration. The true upper dental plates of *Deltoptychius* are identified by the same authors with species of *Streblodus*. We prefer, however, to adopt the interpretation of M'Coy [3] as amended by Davis [4].

Deltoptychius acutus, M'Coy.

1843. *Cochliodus acutus*, L. Agassiz, Poiss. Foss. vol. iii. p. 174 (name only).

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[1] The name only is here mentioned and applied to the species previously described and figured by M'Coy under the name of *Cochliodus acutus*. The type species being thus already well-defined in 1862, the generic name may be regarded as dating from that year.

[2] Pal. Illinois, vol. vii. (1883), p. 92.

[3] Brit. Palæoz. Foss. p. 621.

[4] Trans. Roy. Dublin Soc. [2] vol. i. p. 432.

1855. *Cochliodus acutus*, F. M'Coy, Brit. Palæoz. Foss. p. 621, pl. 3 I. fig. 24.

1862. *Deltoptychius acutus*, Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).

1867. *Cochliodus compactus*, R. Owen, Geol. Mag. vol. iv. pl. iv. fig. 1.

1883. *Deltoptychius acutus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 433, pl. liii. figs. 13–17.

1883. *Deltodus expansus*, J. W. Davis, *tom. cit.* p. 431, pl. liii. figs. 9, 10 (*non* fig. 11).

(?) 1884. *Deltoptychius plicatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 628, pl. xxvi. figs. 13, 14.

(?) 1886. *Deltoptychius plicatus*, J. W. Davis, Geol. Mag. [3] vol. iii. p. 152.

Type. Detached dental plates: Woodwardian Museum, Cambridge.

"Upper" dental plate expanded posteriorly towards the inner border; the large coronal ridge angulated: lateral borders raised into sharp ridges. "Lower" plate with the large median ridge angulated, sharply separated from the upturned postero-lateral area.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland, and Ayrshire, Scotland. Upper Carboniferous Limestone: Yorkshire and Derbyshire.

(i.) *Slightly curved variety (? upper jaw).*

P. 2433–35. Three dental plates described and figured by J. W. Davis, *loc. cit.* p. 433, pl. liii. figs. 15–17; Armagh. *Enniskillen Coll.*

P. 2448–9. Two specimens described and figured as referable to the upper jaw of *Deltodus expansus*, J. W. Davis, *loc. cit.*; Armagh. *Enniskillen Coll.*

P. 2436. Thirty specimens; Armagh. *Enniskillen Coll.*

P. 1455. Four small abraded dental plates; Armagh. *Egerton Coll.*

28725. Two similar plates; Armagh. *Purchased*, 1853.

46045. Imperfect dental plate probably of this species; Beith, Ayrshire. *Presented by R. Craig, Esq.*, 1874.

(ii.) *Inrolled variety (? lower jaw).*

P. 2431–2. Two dental plates described and figured by J. W. Davis, *loc. cit.* p. 433, pl. liii. figs. 13, 14; Armagh. *Enniskillen Coll.*

P. 2437. Twenty specimens; Armagh. *Enniskillen Coll.*

P. 1455 a. Six specimens, one associated with a tooth of *Helodus didymus*; Armagh. *Egerton Coll.*

P. 4888. Two dental plates only differing from the foregoing in their smaller size; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 5352. One imperfect specimen and fragment; Ticknall, near Melbourne, South Derbyshire. *Wilson Coll.*

Deltoptychius gibberulus, Davis.

1838. *Cochliodus contortus,* L. Agassiz, Poiss. Foss. vol. iii. p. 115, pl. xiv. figs. 21, 29–33.

1862. *Deltoptychius gibberulus,* Morris & Roberts, Quart. Journ. Geol. Soc. vol. xviii. p. 100 (name only).

1883. *Deltoptychius gibberulus,* J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 435, pl. liii. figs. 18, 19.

Type. Detached dental plates; British Museum.

"Upper" dental plate much expanded posteriorly towards the inner border; the large coronal ridge broad, rounded; lateral borders not raised into ridges. "Lower" plate with the large median ridge gently rounded and relatively broad; antero-lateral border raised into a sharp ridge.

Form. & Loc. Lower Carboniferous Limestone: Wexford, Ireland: Gloucestershire, Somersetshire, and Shropshire, England. Upper Carboniferous Limestone: Derbyshire.

(i.) *Slightly curved variety (? upper jaw), shown by Agassiz, tom. cit.* pl. xiv. figs. 29–31, *and by Davis, tom. cit.* pl. liii. fig. 19.

P. 2439. Type-specimen; Bristol. *Enniskillen Coll.*

P. 2440. Five dental plates; Bristol. *Enniskillen Coll.*

P. 5225. One specimen; Bristol. *Presented by J. E. Lee, Esq.,* 1885.

P. 1478, P. 1452. Three similar plates; Bristol. *Egerton Coll.*

20575 b, 41167. Six specimens; Bristol. *Purchased,* 1845, 1868.

40331. Three small dental plates; Clevedon, Somersetshire. *Purchased,* 1867.

42189. Small abraded specimen; Oreton, Shropshire. *Baugh Coll.*

P. 1478 a. Two specimens; Hook Point, Wexford. *Egerton Coll.*

23712. Three small specimens; Hook Point, Wexford. *Purchased,* 1849.

(ii.) *Involled variety (? lower jaw), shown by Agassiz, tom. cit.* pl. xiv. figs. 32, 33, *and by Davis, tom. cit.* pl. liii. fig. 18.

P. 2438. Type specimen; Bristol. *Enniskillen Coll.*

P. 2440 a. Imperfect dental plate; Bristol. *Enniskillen Coll.*

20575 a. Imperfect dental plate; Bristol. *Purchased*, 1845.

P. 1478 b. Two specimens; Black Rock, Bristol. *Egerton Coll.*

40329. Perfect, though abraded, specimen; Clevedon, Somersetshire. *Purchased*, 1867.

P. 1478 c. Similar specimen; Hook Point, Wexford. *Egerton Coll.*

P. 5351. Imperfect specimen shown of the natural size in Pl. I. fig. 21; Ticknall, near Melbourne, South Derbyshire. *Wilson Coll.*

P. 5350. Two fragments of worn dental plates, probably of this species; Ticknall. *Wilson Coll.*

The following species have also been founded upon detached dental plates, but there are no examples in the Collection:—

Deltoptychius expansus, St. John & Worthen, Pal. Illinois, vol. vii. (1883), p. 98, pl. v. figs. 9–11 (also figs. 12, 13, *Streblodus*-plates).—St. Louis Limestone; Illinois, Iowa, Missouri.

Deltoptychius nitidus, St. John & Worthen, *tom. cit.* p. 99, pl. v. fig. 16: *Cochliodus nitidus*, J. Leidy, Trans. Amer. Phil. Soc. [2] vol. xi. (1857), p. 87, pl. v. fig. 2.—Chester Limestone; Illinois.

Deltoptychius primus, St. John & Worthen, *tom. cit.* p. 93, pl. v. fig. 6 (also figs. 7, 8, *Streblodus*-plates).—Upper Burlington Limestone; Iowa.

Deltoptychius wachsmuthi, St. John & Worthen, *tom. cit.* p. 93, pl. v. figs. 1, 2 (also figs. 3–5, *Streblodus*-plates).—Keokuk Limestone; Illinois, Iowa, and Missouri.

Deltoptychius warsawensis, St. John & Worthen, *tom. cit.* p. 96, pl. v. fig. 14 (also fig. 15, *Streblodus*-plate).—Warsaw Limestone; Illinois.

As already remarked (p. 205), dental plates of the form here regarded as *Deltoptychius* are described by St. John and Worthen as *Pacilodus worthoni* and *P. springeri*. The Belgian tooth named

Streblodus oblongus by L. G. de Koninck (Faune Calc. Carbf. Belg. pt. i. p. 55, pl. vi. fig. 22) also appears to be referable to *Deltoptychius*.

Genus **DIPLACODUS**[1], Davis.

[Quart. Journ. Geol. Soc. vol. xl. 1884, p. 632.]

An uncertain genus founded upon a fragment of a dental plate resembling the original of Pl. VI. fig. 27, apparently only differing from the supposed lower dental plates of *Deltoptychius* in the remarkable extension of the antero-lateral border indicated by the plain line.

Diplacodus bulboides, Davis.

1884. *Diplacodus bulboides*, J. W. Davis, *loc. cit.* p. 633, pl. xxvii. fig. 20.

Type. Fragment of dental plate; Horne Collection, York Museum. The single known species.

Form. & Loc. Upper Carboniferous Limestone: Yorkshire.

P. 4913. Dental plate shown of the natural size in Pl. VI. fig. 27: Yoredale Rocks, Wensleydale. The coronal surface of the antero-lateral extension, shown in outline, is covered by matrix, but appears to be certainly of the form indicated. *Horne Coll.*

Genus **CYRTONODUS,** Davis.

[Quart. Journ. Geol. Soc. vol. xl. 1884, p. 630.]

A doubtful and provisional genus founded upon triangular dental plates very suggestive of those of *Deltoptychius*, but exhibiting a large rounded coronal prominence antero-laterally, expanded into a wing postero-laterally; the root also extending considerably beyond the crown outwardly. The type species is *Cyrtonodus gibbus*, Davis (*loc. cit.* p. 631, pl. xxvii. figs. 1, 6), from the Yoredale Rocks of Wensleydale, Yorkshire; and it may be noted that the published figures of the plates are so arranged that the antero-lateral margin is directed upwards, and the postero-lateral downwards.

Cyrtonodus hornei, sp. nov.

Type. Detached dental plate; British Museum.

[1] This name is preoccupied (*Diplacodon*, O. C. Marsh, Amer. Journ. Sci. [3] vol. ix. 1875, p. 246), but being only provisional, it may be retained until further evidence of the nature of the teeth is discovered.

Dental plates differing from those of *C. gibbus* in the relatively less antero-posterior extension and the more rounded and prominent character of the coronal elevation.

Form. & Loc. Upper Carboniferous Limestone: Yorkshire.

P. 4908. Type specimen shown, of the natural size, in Pl. VI. fig. 26; also a more imperfect dental plate: Yoredale Rocks, Wensleydale. *Horne Coll.*

49634. Fragment of dental plate; Richmond. *Purchased*, 1878.

According to the views of Agassiz, as interpreted by J. W. Davis, the so-called genera *Stenopterodus*, *Chitonodus*, and *Deltodopsis*, proposed by St. John and Worthen (Pal. Illinois, vol. vii.), must be regarded as comprising miscellaneous dental plates of the various genera enumerated above.

The dental plates of "*Stenopterodus*" (*tom. cit.* p. 100) might well be assigned to *Deltodus* and "*Streblodus*." They are described under the names of *S. elongatus* (*tom. cit.* p. 106, pl. iv. figs. 1–3), from the Warsaw Limestone of Illinois; *S. planus* (*tom. cit.* p. 102, pl. iv. figs. 9–14), from the Upper Burlington Limestone of Iowa and Illinois; and *S.* sp.? (*tom. cit.* p. 105, pl. iv. figs. 15, 16), from the Keokuk Limestone of Illinois. The type species of *Sandalodus* (*S. parvulus*, Newberry and Worthen) is also placed here.

The dental plates of "*Chitonodus*" (*tom. cit.* p. 109) seem to be assignable to *Cochliodus*, *Deltodus*, *Poecilodus*, and "*Streblodus*," and the genus is said (p. 112) to include *Cochliodus latus*, Leidy, *Poecilodus rugosus*, Newberry and Worthen, and *P. ornatus*, Newberry and Worthen. Four other species are distinguished as follows: *C. antiquus* (*tom. cit.* p. 116, pl. vi. fig. 2), from the Lower Burlington Limestone of Iowa; *C. liratus* (*tom. cit.* p. 119, pl. vi. fig. 1), from the St. Louis Limestone of Illinois; *C. springeri* (*tom. cit.* p. 112, pl. vi. figs. 3–15), from the Upper Burlington Limestone of Iowa and Illinois; and *C. tribulis* (*tom. cit.* p. 117, pl. vii. figs. 18–21), from the Keokuk Limestone of Iowa and Illinois.

Deltodopsis (*tom. cit.* p. 158) is separated with hesitation from *Deltodus*, and also includes some dental plates assignable to *Sandalodus*—*e. g.*, the large "upper" plate of *S. morrisii*. The following species are distinguished: *D. affinis* (*tom. cit.* p. 160, pl. xi. fig. 1), from the Warsaw Limestone of Illinois; *D.? lineatus* (*tom. cit.* p. 169, pl. xi. fig. 15), from the Upper Burlington Limestone of Iowa; *D.? convexus* (*tom. cit.* p. 169, pl. xi. figs. 17, 18), from the Upper Burlington Limestone of Iowa; *D.? convolutus* (*tom. cit.* p. 165, pl. xi. figs. 11, 12), from the Upper Burlington Limestone

of Iowa and Illinois; *D.? exornatus* (*tom. cit.* p. 168, pl. xi. fig. 14), from the Warsaw Limestone of Illinois; *D.? inflexus* (*tom. cit.* p. 167, pl. xi. fig. 13), from the Keokuk Limestone of Illinois; *D.? keokuk* (*tom. cit.* p. 169, pl. xi. fig. 16), from the Keokuk Limestone of Illinois; and *D. sancti-ludovici* (*tom. cit.* p. 161, pl. xi. figs. 2–6), from the St. Louis Limestone of Iowa, Illinois, and Missouri. *Deltodus angustus*, Newberry and Worthen, is also placed here.

The genus *Chalcodus*, Zittel (Handb. Palæont. vol. iii. pt. i. 1887, p. 72), from the German Kupferschiefer, though originally referred to the Cochliodontidæ, does not appear to belong to this family: and a brachiopod shell [1] from the Upper Carboniferous of Lo-Ping, China, has also been placed here, under the name of *Leptodus richthofeni*, E. Kayser (Richthofen's Beitr. Paläont. China, 1883, p. 161, pl. xxi. figs. 9–11).

Undetermined Anterior Teeth.

The anterior teeth of the Cochliodontidæ have been described under the provisional generic names of *Helodus*, Agassiz (Poiss. Foss. vol. iii. 1838, p. 104); *Chomatodus*, Agassiz (*tom. cit.* p. 107); *Lophodus*, Romanowsky (Bull. Soc. Imp. Nat. Moscou, vol. xxxvii. 1864, pt. ii. p. 160); and perhaps *Venustodus*, St. John and Worthen (Pal. Illinois, vol. vi. 1875, p. 344). Those named *Helodus planus* by Agassiz are known to be certainly referable to *Psephodus magnus*; and most of the teeth from the Bristol Bone-bed, named *Helodus lævissimus*, doubtless pertain to *Psephodus lævissimus*. The other teeth, however, except *H. simplex*, are probably common to one or more genera or species, and it is thus convenient, upon present evidence, to retain the provisional determinations, as follow. Unless otherwise stated, the specimens were all obtained from undetermined horizons in the Carboniferous Limestone.

I. Large elongated depressed teeth, generally with a longitudinal elevation near one of the long margins, often rising into a median prominence. Such have been described under the names of *Chomatodus cinctus*, Agassiz [2], *Helodus turgidus*,

[1] *Lyttonia*, W. Waagen, Palæont. Indica [13] pt. iv. (1882), p. 395.

[2] Poiss. Foss. vol. iii. (1838), p. 107, pl. xv. figs. 13–21 (in part). Also J. E. Portlock, Rep. Geol. Londonderry (1843), p. 467, pl. xiv. *a*. fig. 9; L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 46, pl. iv. fig. 3, pl. vi. figs. 1–5. *Helodus cinctus*, F. McCoy, Brit. Palæoz. Foss. (1855), p. 617.

Agassiz [1], *Helodus gibberulus*, Agassiz [2], *Helodus crassus*, Davis [3], and *Helodus expansus*, Davis [4].

P. 2918. Type specimen of *Chomatodus cinctus*, Agassiz, figured *tom. cit.* pl. xv. fig. 13[1]; Lower Carboniferous Limestone, Bristol. *Enniskillen Coll.*

20573, 20575, 28537, 34974. Fifteen nearly similar teeth, with a more prominent coronal ridge; Bristol. *Purchased.*

32739–40. Two teeth named *Helodus turgidus*; Bristol. *Presented by S. P. Pratt, Esq.*, 1857.

44853. Similar tooth; Bristol. *Presented by Benjamin Bright, Esq.*, 1873.

P. 1426, P. 1466. Ten similar teeth; Bristol. *Egerton Coll.*

50009. Detached tooth; Bristol. *Trevelyan Bequest*, 1879.

P. 2616, P. 2658. Twelve similar teeth; Bristol. *Enniskillen Coll.*

36467, 41189. Four teeth: Oreton, Shropshire. *Purchased*, 1868.

42217. Forty teeth; Oreton. *Baugh Coll.*

P. 1427. Similar tooth; Settle, Yorkshire. *Egerton Coll.*

P. 2617. Similar tooth; Upper Carboniferous Limestone, Richmond, Yorkshire. *Enniskillen Coll.*

P. 217. Six similar teeth, two with a sharp longitudinal ridge, approaching "*Helodus expansus*"; Oreton. *Weaver-Jones Coll.*

35483. Abraded tooth; Upper Carboniferous Limestone, Richmond, Yorkshire. *Purchased*, 1860.

P. 1474. Tooth of the same kind; Lower Carboniferous Limestone, Hook Point, Wexford, Ireland. *Egerton Coll.*

P. 2618. Two teeth; Hook Point. *Enniskillen Coll.*

[1] Poiss. Foss. vol. iii. p. 106, pl. xv. figs. 1–12. Also F. M'Coy, *op. cit.* p. 623; L. G. de Koninck, *op. cit.* pt. i. p. 39, pl. iv. figs. 13, 14, pl. vi. fig. 21.

[2] *Tom. cit.* p. 106, pl. xii. figs. 1, 2; (?) also H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 269, pl. xxvi. fig. 9. *Lophodus gibberulus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 405, pl. li. fig. 19; (?) also L. G. de Koninck, *op. cit.* pt. i. p. 34, pl. iv. fig. 7.

[3] J. W. Davis, *loc. cit.* p. 453, pl. lix. figs. 1, 2. Including *Chomatodus cinctus*, Ag., in part.

[4] J. W. Davis, *loc. cit.* p. 457, pl. lix. fig. 10. Including *Chomatodus linearis*, Ag., in part.

41201. Five more rounded teeth, with marginal concentric wrinkles; Lower Carboniferous Limestone, Tournai, Belgium. *Purchased*, 1868.

P. 2619, P. 2646. About sixty teeth of similar form, but with smooth coronal surface and having the middle of the crown raised into a large rounded boss; Lower Carboniferous Limestone, Armagh. *Enniskillen Coll.*

P. 2912. Smaller tooth with a low lateral boss in addition to the median, described as *Lophodus gibberulus*, Agass. sp., by J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 405, pl. li. fig. 19; Armagh. *Enniskillen Coll.*

P. 2629. Six similar teeth; Armagh. *Enniskillen Coll.*

P. 2630–1. Two very large teeth, with delicate marginal concentric wrinkles, and with the sharp longitudinal coronal ridge raised into a pointed median apex, forming the type specimens of *Helodus crassus*, J. W. Davis, *loc. cit.*; Armagh. *Enniskillen Coll.*

P. 2632. Twelve similar teeth; Armagh. *Enniskillen Coll.*

P. 1465. Three similar teeth; Armagh. *Egerton Coll.*

20824. Imperfect tooth; Bristol. *Purchased*, 1847.

P. 4914. Nearly similar tooth; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 2611. Tooth with concentric marginal wrinkles and the longitudinal ridge low and sharp, though rising to a median eminence, forming the type specimen of *Helodus expansus*, J. W. Davis, *loc. cit.*; Armagh. *Enniskillen Coll.*

P. 5862. Four teeth of the same kind, but less symmetrical: Armagh. *Enniskillen Coll.*

P. 2654 a. Three teeth, nearly similar, but without the median eminence; Armagh. *Enniskillen Coll.*

P. 2653. Three similar teeth: Upper Carboniferous Limestone, Richmond, Yorkshire. *Enniskillen Coll.*

P. 2651. Tooth of the same form, though slightly curved, resembling some of the teeth included by Agassiz in *Chomatodus linearis*, and described under this name by J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 508, pl. lxi. fig. 1; Bristol. *Enniskillen Coll.*

P. 2615. Three teeth of the form named *Helodus angulatus*, Newberry & Worthen[1]; Burlington Limestone, Quincy, Illinois. *Enniskillen Coll.*

P. 2603. Tooth of the form named *Helodus sulcatus*, Newberry & Worthen[2]; Keokuk Limestone, near Warsaw, Illinois. *Enniskillen Coll.*

II. Large laterally compressed teeth, with a median eminence.

P. 2633–4. Two type specimens of *Helodus tenuis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 454, pl. lix. figs. 3, 4; Armagh. *Enniskillen Coll.*

P. 2635. About forty similar teeth, only differing from those of *Helodus crassus*, Davis, in their extreme lateral compression; Armagh. *Enniskillen Coll.*

P. 2608–9. Two teeth, forming the type specimens of *Helodus clavatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 455, pl. lix. figs. 5, 6; Armagh. *Enniskillen Coll.*

III. Small conical teeth.

P. 2636. Type specimen of *Helodus richmondiensis*, J. W. Davis, Trans Roy. Dublin Soc. [2] vol. i. p. 456, pl. lix. fig. 8; Upper Carboniferous Limestone, Richmond, Yorkshire. *Enniskillen Coll.*

P. 4900. Similar, but slightly larger tooth; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 2606. Type specimen of *Helodus triangularis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 456, pl. lix. fig. 9; Lower Carboniferous Limestone, Armagh. *Enniskillen Coll.*

P. 2612. Similar tooth; Armagh. *Enniskillen Coll.*

P. 4191 a. Smaller tooth, with crimped margin; Armagh. *Enniskillen Coll.*

P. 2607. Type specimen of *Helodus acutus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 455, pl. lix. fig. 7; Armagh. *Enniskillen Coll.*

[1] Pal. Illinois, vol. ii. (1866), p. 83, pl. v. figs. 9–15.
[2] *Tom. cit.* pl. v. fig. 16.

IV. Teeth with rounded or gently elevated crown, sometimes elongated and sometimes of irregular shape, commonly ascribed to *Helodus lævissimus*, Agassiz[1].

P. 2623. Six small series of flat teeth, more or less nearly perfect, resembling the specimen figured by F. M'Coy, Brit. Palæoz. Foss. pl. 3 I. fig. 17; Armagh. *Enniskillen Coll.*

P. 2622. Three small examples; Hook Point, Wexford. *Enniskillen Coll.*

36193. Fourteen teeth, of irregular elongate shape, with gently rounded or raised crowns; Carboniferous Limestone, Oreton, Shropshire. *Purchased*, 1861.

42225. About one hundred small teeth, of irregular shapes, more or less elongated and rounded; Oreton. *Baugh Coll.*

35486 7, 35485 7. Six teeth; Oreton. *Purchased*, 1860.

P. 2621. Twenty-five irregular rounded teeth, some relatively large and approaching "*Chomatodus cinctus*" in characters; Oreton. *Enniskillen Coll.*

42218, 42222. Twenty-four teeth, mostly much elongated and elevated in the middle; Oreton. *Baugh Coll.*

42223-4. Two examples of two elongated teeth associated in natural sequence; Oreton. *Baugh Coll.*

41190. Three associated elongated teeth, with a large coronal prominence at one extremity; Oreton. *Purchased*, 1868.

P. 210, P. 221–6. Seven examples of relatively large teeth, with slightly elevated crowns, and two groups of three in series; Oreton. *Weaver-Jones Coll.*

P. 2325, P. 4538, P. 4539. Fifteen small teeth, mostly similar: Oreton. *Enniskillen Coll.*

40330. Two associated small, flat, elongated teeth, two fused together, and one imperfect broader tooth; Carboniferous Limestone, Clevedon, Somersetshire. *Purchased*, 1867.

[1] L. G. de Koninck, Descr. Anim. Foss. Terr. Carbf. Belg. (1844), p. 614, pl. lv. fig. 3; F. M'Coy, Brit. Palæoz. Foss. (1855), p. 630, pl. 3 I. fig. 17. *Lophodus lævissimus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 33, pl. iv. fig. 6; also J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 404, pl. li. fig. 18.

P. 4909 a. Small tooth, approaching the form described by J. W. Davis as *Lophodus conicus* [1]; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

V. Small elongated teeth with one half of the crown broader and much more raised than the other, the elevation abruptly terminating about the middle of the tooth; described as *Chomatodus* (*Helodus*) *obliquus* by M'Coy [2].

P. 2626. Forty teeth; Armagh. *Enniskillen Coll.*

VI. Small elongated teeth with a relatively large quadrangular coronal elevation, often slightly cleft by a small groove upon one side of its summit, described by M'Coy as *Helodus didymus* [3].

P. 2638. Eighty specimens; Armagh. *Enniskillen Coll.*

P. 2605, P. 2639, P. 2640, P. 4927. Sixty specimens, mostly with the quadrangular elevation very broad; Armagh. *Enniskillen Coll.*

P. 1429. Two similar teeth; Armagh. *Egerton Coll.*

P. 1431 2. Twelve teeth, and three abraded teeth in natural sequence; Armagh. *Egerton Coll.*

28746, 28749, 38507. Seventeen specimens; Armagh. *Purchased*, 1853, 1864.

46040. Small tooth, with elevation more pointed: Beith, Ayrshire. *Presented by Robert Craig, Esq.*, 1874.

46041. Much depressed tooth, with broad elevation; Beith. *Presented by Robert Craig, Esq.*, 1874.

P. 1430. Typical tooth; Monmouthshire. *Egerton Coll.*

P. 218. Tooth; Oreton, Shropshire. *Weaver-Jones Coll.*

P. 2657. Three imperfect teeth; Oreton. *Enniskillen Coll.*

[1] Quart. Journ. Geol. Soc. vol. xl. (1884), p. 627, pl. xxvi. fig. 18.

[2] Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 124; Brit. Palæoz. Foss. (1855), p. 618, pl. 3 K. fig. 3.

[3] Brit. Palæoz. Foss. (1855), p. 650, pl. 3 I. figs. 18–20. *Lophodus didymus*, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 162, pl. iv. fig. 23; also J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 407, pl. li. fig. 21.

P. 4909. Two teeth, with relatively narrow coronal elevation, resembling the type of *Lophodus bifurcatus*, J. W. Davis[1]: Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 5346. Two small teeth, and six fragments with more rounded coronal elevations; Upper Carboniferous Limestone, Ticknall, near Melbourne, S. Derbyshire. *Wilson Coll.*

VII. Similar teeth, with the coronal eminence pointed, described by M'Coy as *Helodus appendiculatus*[2].

P. 2627-8. About fifty specimens: Armagh. *Enniskillen Coll.*

P. 2916. Two small series of five naturally associated teeth; Armagh. *Enniskillen Coll.*

P. 1433. One tooth; Armagh. *Egerton Coll.*

36194, 42218, 42229 a. Forty-five teeth, more or less broken; Oreton, Shropshire. *Purchased*, 1861, *and Baugh Coll.*

P. 224. Four teeth; Oreton. *Weaver-Jones Coll.*

P. 2627 a. Eight specimens, one showing three imperfect teeth in series, and one with two of unequal size; Oreton. *Enniskillen Coll.*

35743. Tooth; Bewdley, Worcestershire. *Purchased*, 1860.

34981, 34981 a. Three teeth; Black Rock, Bristol. *Purchased*, 1860.

P. 2637. Tooth; Upper Carboniferous Limestone, Richmond, Yorkshire. *Enniskillen Coll.*

VIII. Much elongated narrow teeth, with a more or less pointed and transversely ridged coronal eminence, nearer one extremity than the other, described by M'Coy as *Helodus mammillaris*[3]. Some are not readily distinguishable from abraded teeth of *Orodus elongatus*.

P. 2644. About forty specimens: Armagh. *Enniskillen Coll.*

[1] Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 408, pl. li. fig. 25; and Quart. Journ. Geol. Soc. vol. xl. (1884), p. 628, pl. xxvii. fig. 5.

[2] Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 123.

[3] Brit. Palæoz. Foss. (1855), p. 631, pl. 3 r. fig. 16. *Lophodus mammillaris*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 35, pl. iv. figs. 9–11; also J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 406, pl. li. fig. 20.

P. 2614 b. Tooth associated with one of "*Helodus didymus*;" Armagh. *Enniskillen Coll.*

P. 2644 a, P. 2644 b. Very narrow tooth, with sharply pointed eminence; also two others apparently similar; Armagh. *Enniskillen Coll.*

P. 1436. Four teeth naturally arranged in series; Hook Point, Wexford. *Egerton Coll.*

P. 2645. Small tooth; Bone-bed of Lower Limestone Shales, Bristol. *Enniskillen Coll.*

P. 4911. Two small teeth; Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

28723. Perfect tooth; Lower Carboniferous Limestone, Tournai, Belgium. *Purchased*, 1853.

IX. Elongated teeth with a longitudinal median keel rising into an eminence and crenulated: margins with more or less distinct concentric wrinkles. [*Venustodus*, St. John & Worthen.]

P. 5290. Tooth of the form described by J. W. Davis as *Lophodus serratus*[1]; Yoredale Rocks, Yorkshire. *Purchased*, 1880.

P. 4910. Three similar teeth; Wensleydale, Yorkshire. *Horne Coll.*

P. 5345. Four similar teeth, imperfect, two figured, of the natural size, in Pl. I. figs. 16, 17; Upper Carboniferous Limestone, Ticknall, Melbourne, S. Derbyshire. *Wilson Coll.*

44855. Larger tooth, with more feeble serrations; Bristol. *Presented by Benjamin Bright, Esq.*, 1873.

P. 2628 a. Nearly similar tooth, and fragment with more pointed coronal eminence; Armagh. *Enniskillen Coll.*

46043. Unabraded tooth; Beith, Ayrshire. *Presented by Robert Craig, Esq.*, 1874.

P. 3010, P. 3011. Type specimen of *Harpacodus clavatus*, Davis[2], and a fragmentary tooth, differing only from the foregoing in their smaller size, and the relatively less number and larger dimensions of the coronal denticulations; Armagh. *Enniskillen Coll.*

[1] Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 408, pl. li. figs. 23, 24; Quart. Journ. Geol. Soc. vol. xl. (1884), p. 627, pl. xxvii. fig. 19. More robust teeth of the same type from Armagh are named *Chomatodus denticulatus*, F. M'Coy (Ann. Mag. Nat. Hist. [2] vol. ii. 1848, p. 124; and Brit. Palæoz. Foss. 1855, p. 618, pl. 3 K. fig. 9).

[2] Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 515, pl. lxi. fig. 20.

X. Much arched narrow tooth.

P. 2911. Type specimen of *Rhamphodus dispar*, J. W. Davis, *tom. cit.* p. 402, pl. li. fig. 17 ; Armagh. *Enniskillen Coll.*

Most of the teeth upon which the following "species" are founded are also referable to the anterior portion of the jaws of Cochliodonts, but there are no examples in the Collection :—

Helodus antiquissimus, E. von Eichwald, Leth. Ross. vol. i. (1869), p. 1545.—Carboniferous Limestone ; Government of Toula.

Helodus aversus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 268, pl. xxvi. fig. 8.—Carboniferous Limestone ; Government of Toula, Russia.

Helodus biformis, Newberry & Worthen, Pal. Illinois, vol. ii. p. 77, pl. iv. fig. 22.—Kinderhook Limestone ; Iowa.

Helodus carbonarius, Newberry & Worthen, *op. cit.* vol. ii. p. 75, pl. iv. fig. 20.—Coal-Measures ; Illinois.

Helodus compressus, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 360, pl. iii. fig. 15.—Burlington Limestone : Illinois. [*Non* Newberry & Worthen, *op. cit.* vol. ii. p. 78, pl. v. fig. 1,—see *Hybocladodus compressus*, p. 29.]

Helodus coniculus, Newberry & Worthen, *op. cit.* vol. ii. p. 75, pl. iv. fig. 19 ; J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1879, p. 344.—Keokuk Limestone ; Illinois. St. Louis Limestone ; Indiana. Burlington Limestone ; Iowa.

Helodus consolidatus, Newberry & Worthen, *op. cit.* vol. ii. p. 87, pl. vi. figs. 1, 2.—Keokuk Limestone : Missouri and Illinois.

Helodus crenulatus, Newberry & Worthen, *op. cit.* vol. ii. p. 82, pl. v. fig. 7.—Keokuk Limestone ; Illinois.

Helodus dens-humani, Newberry & Worthen, *op. cit.* vol. ii. p. 76, pl. iv. fig. 21.—Keokuk Limestone ; Illinois.

Helodus denticulatus, Newberry & Worthen, *op. cit.* vol. ii. p. 81, pl. v. fig. 6. *Helodus*(?) *denticulatus*, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 317.—Keokuk Limestone ; Illinois.

Helodus elytra, Newberry & Worthen, *op. cit.* vol. ii. p. 78, pl. iv. fig. 23.—Keokuk Limestone ; Illinois.

Helodus gibbus, J. Leidy, Trans. Amer. Phil. Soc. [2] vol. xi. (1857), p. 88, pl. v. fig. 18.—Carboniferous Limestone ; Illinois.

Helodus laevis, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78 (1879), p. 343.—St. Louis Limestone ; Indiana.

Helodus limax, Newberry & Worthen, *op. cit.* vol. ii. p. 80, pl. v. fig. 5.—Burlington Limestone ; Iowa.

Helodus mons-canus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 288, pl. xxviii. fig. 2.—Carboniferous Limestone; Mjatschkowa, Moscow.

Helodus placenta, Newberry & Worthen, *op. cit.* vol. ii. p. 80, pl. v. fig. 4.—Kinderhook Limestone; Iowa.

Helodus politus, Newberry & Worthen, *op. cit.* vol. ii. p. 79, pl. v. fig. 2.—Keokuk Limestone; Illinois.

Helodus pusillus: *Polyrhizodus pusillus*, F. M'Coy, Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 126; and Brit. Palæoz. Foss. (1855), p. 642, pl. 3 K. fig. 2.—Lower Carboniferous Limestone; Armagh.

Helodus rugosus, Newberry & Worthen, *op. cit.* vol. iv. (1870), p. 359, pl. ii. fig. 10.—Coal-Measures; Illinois.

Helodus undulatus, Newberry & Worthen, *op. cit.* vol. ii. p. 82, pl. v. fig. 8.—Keokuk Limestone; Illinois.

Helodopsis abbreviata, W. Waagen, Pal. Ind. [13] pt. i. (1879), p. 15, pl. i. fig. 6.—Productus Limestone; Salt Range, India.

Helodopsis elongata, W. Waagen, *loc. cit.* p. 14, pl. i. figs. 3, 4.—Productus Limestone; Salt Range.

Lophodus angularis, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. (1884), p. 628, pl. xxvii. fig. 25.—Yoredale Rocks; Wensleydale, Yorkshire.

Lophodus contractus, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 33, pl. iv. figs. 4, 5. *Helodus contractus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 270, pl. xxvi. fig. 10 (misprinted *H. angustus*).—Carboniferous Limestone: Government of Toula, Russia, and Belgium.

Lophodus irregularis, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 161, pl. iii. fig. 21.—Carboniferous Limestone; Government of Toula.

Lophodus lanceolatus, H. Romanowsky, *tom. cit.* p. 162, pl. iv. fig. 22; L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 36, pl. iv. fig. 12.—Carboniferous Limestone; Government of Toula, Russia, and Belgium.

Lophodus levis, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 409, pl. li. figs. 26, 27; Quart. Journ. Geol. Soc. vol. xl. (1884), p. 627.—Yoredale Rocks; Wensleydale.

Lophodus linearis, H. Romanowsky, *tom. cit.* p. 162, pl. iv. fig. 26.—Carboniferous Limestone; Government of Toula.

Lophodus marginalis, H. Romanowsky, *tom. cit.* p. 161, pl. iii. fig. 20.—Carboniferous Limestone; Government of Toula.

Lophodus margodentatus, H. Romanowsky, *tom. cit.* p. 162, pl. iv.

figs. 24, 25.—Carboniferous Limestone; Government of Toula, Russia.

(?) *Lophodus reticulatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 407, pl. li. fig. 22; Quart. Journ. Geol. Soc. vol. xl. (1884), p. 626, pl. xxvii. fig. 2.—Yoredale Rocks; Wensleydale, Yorkshire.

Lophodus sinuosus, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 409, pl. li. fig. 28.—Upper Carboniferous Limestone; Yorkshire.

Chomatodus angustus, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78 (1879), p. 342.—St. Louis Limestone; Indiana.

Chomatodus arcuatus, O. St. John, Proc. Amer. Phil. Soc. vol. xi. (1870), p. 435, and in Hayden's Final Rep. Geol. Surv. Nebraska (1872), p. 243, pl. vi. fig. 14; St. John & Worthen, Pal. Illinois, vol. vi. (1875), pl. x. fig. 23.—Upper Coal-Measures; Nebraska and Iowa.

Chomatodus chesterensis, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 363, pl. x. figs. 15–17.—Chester Limestone; Illinois.

Chomatodus comptus, St. John & Worthen, *op. cit.* vol. vi. p. 356, pl. x. figs. 19–22.—Burlington Limestone; Iowa.

Chomatodus elegans, Newberry & Worthen, *op. cit.* vol. ii. p. 86, pl. v. fig. 18.—Keokuk Limestone; Iowa.

(?) *Chomatodus inconstans*, St. John & Worthen, *op. cit.* vol. vi. p. 360, pl. x. figs. 5–14.—St. Louis Limestone; Iowa.

Chomatodus obliquus, J. S. Newberry, *loc. cit.* p. 342.—St. Louis Limestone; Indiana.

Chomatodus obscurus, J. Leidy, Trans. Amer. Phil. Soc. [2] vol. xi. (1860), p. 89, pl. v. figs. 22, 23.—Carboniferous Limestone; Illinois. [*Tanaodus*, St. John & Worthen.]

Chomatodus selliformis, J. S. Newberry, *loc. cit.* p. 341.—St. Louis Limestone, Illinois.

Chomatodus varsoviensis, St. John & Worthen, *op. cit.* vol. vi. p. 363, pl. x. figs. 1–4.—Warsaw Limestone; Illinois and Missouri.

Venustodus argutus, St. John & Worthen, *op. cit.* vol. vi. p. 352, pl. ix. figs. 5, 6.—Chester Limestone; Illinois.

Venustodus leidyi, St. John & Worthen, *op. cit.* vol. vi. p. 350, pl. ix. figs. 1–4; *Chomatodus venustus*, J. Leidy, Trans. Amer. Phil. Soc. [2] vol. xi. (1857), p. 89, pl. v. figs. 19–21.—St. Louis Limestone; Illinois and Missouri.

Venustodus robustus, St. John & Worthen, *op. cit.* vol. vi. p. 345, pl. ix. figs. 15–18.—Burlington Limestone; Iowa.

Venustodus tenuicristatus, St. John & Worthen, *op. cit.* vol. vi. p. 348, pl. ix. figs. 19–24.—Keokuk Limestone; Illinois, Iowa, and Missouri.

Venustodus variabilis, St. John & Worthen, *op. cit.* vol. vi. p. 346, pl. ix. figs. 7–14.—Burlington Limestone; Illinois and Iowa.

(?) *Cranodus zonatus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 54, pl. vii. fig. 4.—Carboniferous Limestone: Government of Moscow, Russia.

(?) *Tomodus argutus*, H. Trautschold, *tom. cit.* p. 55, pl. vii. fig. 8: *Octotomodus argutus*, H. Trautschold, Bull. Soc. Imp. Nat. Moscou, 1880, pt. ii. p. 140.—Carboniferous Limestone; Government of Moscow, Russia.

Other anterior teeth of Cochliodonts, from the Lower Carboniferous of Russia, have also been described by Semenow & Möller, Bull. Acad. Imp. Sci. St. Pétersb. vol. vii. (1864), p. 234, pl. i. figs. 1–8, 10.

To the Cochliodontidæ also may possibly be assigned the small prehensile teeth described under the following names:—

Periplectrodus compressus, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 326, pl. viii. fig. 26.—St. Louis Limestone; Illinois.

Periplectrodus expansus, St. John & Worthen, *tom. cit.* p. 327, pl. viii. fig. 27.—Chester Limestone; Illinois.

Periplectrodus warreni, St. John & Worthen, *tom. cit.* p. 325, pl. viii. fig. 25.—Burlington Limestone; Iowa.

A single undetermined tooth from the Pliocene of Tuscany, certainly not Cochliodont, is described under the name of *Helodus brugnonei* by R. Lawley, Nuovi Studi sopra ai Pesci, etc., Colline Toscane (1876), p. 83: and an equally doubtful fossil from the Rhætic of Stuttgart is named *Chomatodus sphenodiscus*, Plien., in Meyer & Plieninger's Beitr. Pal. Württembergs (1844), p. 55.

Family CESTRACIONTIDÆ.

Dorsal fins each armed with a spine, the first opposite to the space between the pectoral and pelvic fins. Teeth mostly obtuse, never fused into continuous plates: several series simultaneously in function.

No distinctive characteristics of value having yet been discovered, the so-called Orodontidæ and Hybodontidæ are included in this family.

Genus **ORODUS,** Agassiz.

[Poiss. Foss. vol. iii. 1838, p. 96.]

An indefinable Carboniferous genus known only by teeth, which are not generically distinguishable from those of the Mesozoic *Hybodus*. The teeth, however, are not associated with other remains characteristic of the latter genus, and may thus be regarded as pertaining to a distinct fish. They are laterally elongated, having the coronal contour raised mesially, and the surface ornamented by more or less prominent transverse wrinkles, rising from each long margin, or from a median longitudinal crest. The root is often much deeper than the crown.

It is probable that the dorsal fin-spines originally named *Ctenacanthus* pertain to this genus [1].

Orodus cinctus, Agassiz.

1838. *Orodus cinctus*, L. Agassiz, Poiss. Foss. vol. iii. p. 96, pl. xi. figs. 1–4.

1878. *Orodus cinctus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. p. 31, pl. iv. fig. 2.

1883. *Orodus cinctus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 392, pl. l. figs. 8, 9.

Type. Detached teeth ; Bristol Museum.

The type species, of medium size. Median coronal prominence large, more or less rounded : longitudinal median ridge rounded, nearly even ; transverse ridges and furrows broad and large.

It is uncertain at present to what extent the rounded character of the teeth of *O. cinctus* is due to post-mortem abrasion. Except in size, the teeth exhibit a very close approximation to those of *O. ramosus*, as already remarked by L. G. de Koninck and J. W. Davis. It seems advisable, however, to retain the species provisionally distinct.

Form. & Loc. Bone-bed of Lower Limestone Shales: Bristol. Lower Carboniferous Limestone (Bed I *c*): Tournai, Belgium [2].

P. 2713. Abraded tooth, figured by J. W. Davis, *loc. cit.* pl. l. fig. 9. *Enniskillen Coll.*

P. 1472. A broken similar, but less abraded tooth. *Egerton Coll.*

[1] See especially J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. p. 54.

[2] A very doubtful tooth from the Lower Carboniferous of Russia is also recorded under the name of *O. cinctus* by H. Trautschold, Nouv. Mém Soc Imp. Nat. Moscou, vol. xiv. (1879), p. 52, pl. vii. fig. 2.

P. 2713 a. Two fragments of small, much elongated teeth.
Enniskillen Coll.

P. 5863. Two small, much elongated teeth.

P. 2677. Two small teeth, naturally associated, with prominent longitudinal crest, probably of this species.
Enniskillen Coll.

Orodus ramosus, Agassiz.

1838. *Orodus ramosus*, L. Agassiz, Poiss. Foss. vol. iii. p. 97, pl. xi. figs. 5–8.
1838. *Helodus subteres*, L. Agassiz, *tom. cit.* p. 105, pl. xii. figs. 3, 4.
1844. *Orodus ramosus*, L. G. de Koninck, Descr. Anim. Foss. Terr. Carbf. Belg. p. 613, pl. lv. fig. 2.
1875. *Orodus ramosus*, W. H. Baily, Figs. Charact. Brit. Foss. p. 120, pl. xli. fig. 10.
1876. *Orodus ramosus*, F. Roemer, Leth. Palæoz. pl. xlviii. fig. 8.
1878. *Orodus ramosus*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. p. 30, pl. iv. fig. 1.
1883. *Orodus ramosus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 390, pl. l. figs. 1–7.
1883. *Orodus subteres*, J. W. Davis, *tom. cit.* p. 399, pl. li. fig. 15.

Type. Detached teeth; British Museum (in part).

A very large species, the teeth sometimes attaining a length of 0·1. Dental crown gently raised to a transversely angulated, more or less median eminence: the elongated lateral portions with a sharp, low, wavy longitudinal ridge, rarely mesially placed, but commonly much nearer to one side than to the other. The coronal surface is wrinkled by a numerous series of branching angulated ridges, sometimes crenulated, extending transversely from the low longitudinal crest.

The so-called *Helodus subteres* may be regarded as a much abraded tooth of this species. The Russian teeth described by Romanowsky [1] and Trautschold [2] as *O. ramosus* are very doubtfully determinable as such; and the same may be said of the tooth from Hook Point, Wexford, figured by Portlock [3].

Form. & Loc. Lower Carboniferous Limestone: Somersetshire, Gloucestershire, and Belgium. Carboniferous Limestone: Shropshire and Monmouthshire.

[1] Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 158, pl. iii. fig. 2.
[2] Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 292, woodcut.
[3] Rep. Geol. Londonderry (1843), pl. xiv A. fig. 8.

P. 2703. One of the type specimens, figured by Agassiz, *tom. cit.* pl. xi. fig. 7; Bristol. *Enniskillen Coll.*

P. 2700. Two associated teeth, figured by J. W. Davis, *tom. cit.* pl. l. fig. 3; Bristol. *Enniskillen Coll.*

P. 2701 b. Very large tooth; Bristol. *Enniskillen Coll.*

P. 1469. Two large teeth; Bristol. *Egerton Coll.*

20829. Large imperfect tooth; Bristol. *Purchased*, 1847.

P. 2701 a, P. 2701. A very broad curved tooth, and four smaller: Bristol. *Enniskillen Coll.*

P. 2702. Two imperfect abraded small teeth; Bristol. *Enniskillen Coll.*

P. 1470. Three small teeth, closely approaching *O. cinctus*; Bristol. *Egerton Coll.*

20830–1, 34976. Portions of three small teeth; Bristol. *Purchased*, 1847 *and* 1860.

P. 2696. Large abraded tooth: Clevedon, Somersetshire. *Enniskillen Coll.*

42169–71. Three examples of two large teeth in juxtaposition, slightly broken; Oreton, Shropshire. *Baugh Coll.*

42168. About fifty specimens, some large, some small, many with the abraded coronal surface as smooth as in the so-called *Helodus subteres*, and three displayed in vertical longitudinal section; Oreton. *Baugh Coll.*

42172. Portions of three small teeth in natural series; Oreton. *Baugh Coll.*

36196. Large long narrow tooth; Oreton. *Purchased*, 1861.

41186–88. Eight teeth, large and small, one abraded; Oreton. *Purchased*, 1868.

P. 214. A large narrow tooth, and one abraded; Oreton. *Weaver-Jones Coll.*

P. 234. Two abraded teeth, and two similar fragments; Oreton. *Weaver-Jones Coll.*

P. 2697–8. Two small teeth figured by J. W. Davis, *tom. cit.* pl. l. figs. 6, 7; Oreton. *Enniskillen Coll.*

P. 2695. An abraded specimen, and three similar portions of teeth; *Enniskillen Coll.*

P. 2694, P. 2699, P. 2712. Twenty small teeth; Oreton. *Enniskillen Coll.*

36191. Small tooth: Cleobury, Shropshire. *Purchased*, 1861.

35463–65. Three imperfect teeth; Breton, near Clee Hill, Shropshire. *Purchased*, 1859.

P. 1471. Fine dental crown; Monmouthshire. *Egerton Coll.*

28752. Tooth figured by L. G. de Koninck, Anim. Foss. 1844, pl. lv. fig. 2; Feluy, Belgium. *Purchased*, 1853.

42882. Small perfect tooth, detached from matrix: Belgium. *Van Breda Coll.*

Orodus ornatus, Newberry & Worthen.

1866. *Orodus ornatus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 65, pl. iv. figs. 7, 8.

1879. *Orodus ornatus*, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78, p. 346.

Type. Detached teeth.

Teeth of small size, not attaining a greater length than 0·015. Coronal contour gradually rising into the median eminence, covered with numerous very large transverse wrinkles, irregular and branching, radiating from the median cone and from the imperfectly marked median longitudinal crest.

Form. & Loc. Lower Carboniferous (Keokuk Limestone): Illinois and Indiana, U.S.A.

P. 2717. Two teeth; Warsaw, Illinois. *Enniskillen Coll.*

Orodus elongatus, Davis.

1883. *Orodus elongatus*, J. W. Davis (*ex* Agassiz, MS.), Trans. Roy. Dublin Soc. [2] vol. i. p. 394, pl. li. figs. 1–3.

1883. *Orodus angustus*, J. W. Davis (*ex* Agassiz, MS.), *tom. cit.* p. 395, pl. li. fig. 4.

Type. Detached teeth; British Museum.

Teeth extremely long and narrow. Coronal contour gradually rising into a more or less median, transversely angulated eminence: longitudinal crest sharp, slightly wavy, with prominent transverse wrinkles, extending on either side, usually not branching, but rarely bifurcated distally.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2722–24. Type specimens. *Enniskillen Coll.*

P. 2725. Five teeth, two much abraded. *Enniskillen Coll.*

Orodus catenatus, Davis.

1843. *Orodus catenatus*, J. E. Portlock (*ex* Agassiz, MS.), Rep. Geol. Londonderry, p. 461 (name only).

1883. *Orodus catenatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 395, pl. li. fig. 5.

Type. Detached tooth; British Museum.

Teeth comparatively small, the type specimen only measuring 0·008 in length. Coronal contour gradually rising to the median eminence, which is almost pointed and strongly wrinkled: longitudinal crest slightly divided into a series of small eminences, from each of which diverges a prominent, transverse, bifurcating wrinkle on either side.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2715. Type specimen. *Enniskillen Coll.*

P. 2715 a. Imperfect tooth, and three teeth associated in series. *Enniskillen Coll.*

Orodus tuberculatus, Newberry & Worthen.

1866. *Orodus tuberculatus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 66, pl. iv. fig. 9.

Type. Detached tooth.

Teeth small, short, the coronal contour gradually rising to the pointed median eminence; lateral portion of crown on each side faintly divided into two or three small eminences. Coronal surface completely ornamented with large wrinkles, diverging from the apices.

Form. & Loc. Lower Carboniferous (Burlington Limestone): Illinois and Iowa, U.S.A.

P. 2729. Tooth; Burlington, Iowa. *Enniskillen Coll.*

Orodus moniliformis, Davis.

1883. *Orodus moniliformis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 398, pl. li. figs. 10–12.

1883. *Orodus ornatus*, J. W. Davis (*non* Newberry & Worthen), *tom. cit.* p. 397, pl. li. fig. 9.

Type. Detached teeth; British Museum.

Teeth much elongated, of small size, having the crown divided

into a series of more or less rounded eminences by deep transverse furrows. Median coronal eminence very large and prominent, dome-shaped, with an apical point from which radiate short delicate wrinkles. The sides of the crown are marked by large rounded, transverse plications, which are sometimes beaded, and often extend nearly to the apices of the lateral eminences.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland. Upper Carboniferous Limestone: Yorkshire, England.

P. 2719–21. Type specimens; Armagh. *Enniskillen Coll.*

P. 2714. Twelve broken teeth; Armagh. Some show the beaded character of the transverse wrinkles; and in two there are indications of a longitudinal beaded crest. *Enniskillen Coll.*

P. 4906. Typical tooth: Yoredale Rocks, Wensleydale, Yorkshire. *Horne Coll.*

P. 2718. Specimen described by J. W. Davis, *loc. cit.*, as *O. ornatus*; Richmond, Yorkshire. *Enniskillen Coll.*

Orodus mammillaris, Newberry & Worthen.

1866. *Orodus mammillaris*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 66, pl. iv. fig. 10.

Type. Detached tooth.

Teeth scarcely distinguishable from those of *O. moniliformis*, except by the greater prominence and more beaded character of the transverse plications upon the median eminence.

Form. & Loc. Lower Carboniferous (Keokuk Limestone): Illinois, U.S.A.

P. 2728. Three imperfect teeth; Warsaw, Illinois. *Enniskillen Coll.*

P. 2716. Small narrow tooth, perhaps of this species; Warsaw. *Enniskillen Coll.*

Orodus elegantulus, Newberry & Worthen.

1866. *Orodus elegantulus*, Newberry & Worthen, Pal. Illinois, vol. ii. p. 64, pl. iv. fig. 6.

(?) 1875. *Orodus elegantulus* (?), J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. p. 51, pl. lviii. fig. 12.

1879. *Orodus elegantulus*, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78, p. 346.

Type. Detached tooth.

Teeth very similar to those of *O. moniliformis* and *O. mammillaris*, but with the transverse wrinkles short and faintly marked.

Form. & Loc. Lower Carboniferous (Burlington Limestone): Iowa, U.S.A. Keokuk Limestone: Indiana (*Newberry*). (?) Cleveland Shale: Ohio.

P. 2727. Tooth with much pointed eminences; Augusta, Iowa. *Enniskillen Coll.*

Orodus tenuis, Davis.

1883. *Orodus tenuis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 399, pl. li. fig. 14.

Type. Detached abraded tooth; British Museum.

Founded upon a much abraded imperfect tooth, long and narrow, with very high pointed median eminence, and with an angulated longitudinal median crest. Only two transverse wrinkles remain at the base of the median cone.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2710. Type specimen. *Enniskillen Coll.*

Orodus (?) gibbus, Davis.

1843. *Orodus gibbus*, J. E. Portlock (*ex* Agassiz, MS.), Rep. Geol. Londonderry, p. 461 (name only).

1883. *Orodus gibbus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 396, pl. li. figs. 6, 7.

Type. Detached teeth; British Museum.

A very doubtful species founded upon the teeth mentioned below. The median eminence is prominent and gibbous; there is no longitudinal crest, and the transverse wrinkles are reduced to small marginal crenulations.

Form. & Loc. Lower Carboniferous Limestone: Armagh, Ireland.

P. 2704-5. Type specimens, the second very suggestive of a tooth of *Psephodus magnus*. *Enniskillen Coll.*

P. 2709. Three teeth regarded as probably belonging to this species by J. W. Davis, *loc. cit.* *Enniskillen Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Orodus alleni, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 310, pl. vii. fig. 19.—Lower Coal-Measures; Iowa.

Orodus carinatus, St. John & Worthen, *op. cit.* vol. vi. p. 307, pl. v. fig. 24.—Keokuk Limestone; Iowa.

Orodus colletti, J. S. Newberry, Ann. Rep. Geol. Surv. Indiana, 1876–78 (1879), p. 343.—St. Louis Limestone; Indiana.

Orodus compressus, F. M'Coy, Ann. Mag. Nat. Hist. [2] vol. ii.

(1848), p. 131; J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 394, pl. l. fig. 11.—Lower Carboniferous Limestone; Armagh, Ireland.

Orodus dædaleus, St. John & Worthen, *op. cit.* vol. vi. p. 301, pl. vi. figs. 7, 8.—Kinderhook Limestone; Iowa.

Orodus decussatus, St. John & Worthen, *op. cit.* vol. vi. p. 300, pl. vi. figs. 10–15.—Kinderhook Limestone; Iowa.

Orodus elegans, H. Romanowsky, Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 157, pl. iii. fig. 1: (?) *O. ramosus*, H. Romanowsky (*non* Agassiz), *ibid.* p. 158, pl. iii. fig. 2.—Carboniferous Limestone; Government of Toula, Russia.

Orodus excentricus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 268, pl. xxvi. fig. 6.—Carboniferous Limestone; Government of Toula, Russia.

Orodus fastigiatus, St. John & Worthen, *op. cit.* vol. vi. p. 306, pl. vi. figs. 1–3.—Upper Burlington Limestone; Iowa.

Orodus inæquilateras, H. Trautschold, *loc. cit.* vol. xiii. (1874), p. 292, pl. xxviii. fig. 8.—Carboniferous Limestone; Government of Moscow, Russia.

Orodus major, St. John & Worthen, *op. cit.* vol. vi. p. 302, pl. vii. fig. 10.—Lower Burlington Limestone; Iowa.

Orodus minusculus, Newberry & Worthen, Pal. Illinois, vol. ii. (1866), p. 67, pl. iv. fig. 11.—Keokuk Limestone; Illinois.

Orodus minutus, Newberry & Worthen, *op. cit.* vol. ii. p. 68, pl. iv. fig. 12.—Keokuk Limestone; Illinois.

Orodus (?) *multicarinatus*, Newberry & Worthen, *op. cit.* vol. ii. p. 62, pl. iv. fig. 13.—Kinderhook Beds; Indiana.

Orodus neglectus, St. John & Worthen, *op. cit.* vol. vi. p. 308, pl. vi. fig. 26.—St. Louis Limestone; Illinois and Iowa.

Orodus (?) *parallelus*, St. John & Worthen, *op. cit.* vol. vi. p. 295, pl. v. fig. 23.—Upper Kinderhook Limestone; Iowa.

Orodus parvulus, St. John & Worthen, *op. cit.* vol. vi. p. 309, pl. vi. fig. 6.—Upper St. Louis Limestone; Illinois.

Orodus plicatus, Newberry & Worthen, *op. cit.* vol. ii. p. 63, pl. iv. fig. 5.—St. Louis Limestone; Missouri.

Orodus porosus, F. M'Coy, Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 131; J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 393, pl. l. fig. 10.—Lower Carboniferous Limestone; Armagh, Ireland.

Orodus reedi, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 398, pl. li. fig. 13.—Carboniferous Limestone; Settle, Yorkshire.

Orodus sculptus, J. W. Davis, *tom. cit.* p. 396, pl. li. fig. 8.—Lower Carboniferous Limestone; Bristol.

Orodus sublævis, H. Trautschold, *loc. cit.* vol. xiii. (1874), p. 268, pl. xxvi. fig. 7.—Carboniferous Limestone; Government of Toula, Russia.

Orodus tumidus, H. Trautschold, *loc. cit.* vol. xiii. p. 267, pl. xxvi. fig. 5.—Carboniferous Limestone; Government of Toula.

Orodus turgidus, St. John & Worthen, *op. cit.* vol. vi. p. 310, pl. vi. figs. 4, 5.—Chester Limestone; Illinois.

Orodus variabilis, J. S. Newberry, Rep. Geol. Surv. Ohio, vol. ii. pt. ii. (1875), p. 50, pl. lviii. fig. 11.—Waverly Group; Ohio and Kentucky.

Orodus variocostatus, St. John & Worthen, *op. cit.* vol. vi. p. 304, pl. vii. figs. 1-9: (?) *Helodus gibbosus*, Newberry & Worthen, *op. cit.* vol. ii. p. 79, pl. v. fig. 3.—Upper Burlington Limestone; Iowa and Illinois.

Orodus whitei, St. John & Worthen, *op. cit.* vol. vi. p. 297, pl. vi. fig. 25.—Upper Kinderhook Limestone; Iowa.

Genus **CAMPODUS**, L. G. de Koninck.

[Descr. Anim. Foss. Terr. Carbf. Belg. 1844, p. 617.]

Syn. *Lophodus*, Newberry & Worthen (*non* Romanowsky), Pal. Illinois, vol. iv. 1870, p. 360.
Agassizodus, St. John & Worthen, Pal. Illinois, vol. vi. 1875, p. 311.
Arpagodus, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. 1879, p. 59.

Dentition very similar to that of *Orodus*, but distinguished by the buttressed condition of the coronal borders, and "the relatively fewer rows of acuminate teeth, as inferred from this feature being so prevalent in all collections of *Orodi*, while the linear forms are least commonly met with" (St. John & Worthen).

A large portion of the dentition of one jaw of the so-called *Agassizodus variabilis* is described by St. John & Worthen[1], and the restoration amended by M. Lohest[2].

Campodus agassizianus, L. G. de Koninck.

1844. *Campodus agassizianus*, L. G. de Koninck, Descr. Anim. Foss. Terr. Carbf. Belg. p. 617, pl. lv. fig. 1.

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[1] Pal. Illinois, vol. vi. p. 311, pl. viii. figs. 1-22.
[2] Ann. Soc. Géol. Belg. vol. xi. (1883), p. 305.

(?) 1875. *Agassizodus virginianus*, St. John & Worthen, Pal. Illinois, vol. vi. p. 321, pl. viii. fig. 23.

1883. *Campodus agassizianus*, M. Lohest, Ann. Soc. Géol. Belg. vol. xi. p. 305, pl. iii. figs. 1–3, pl. iv. figs. 1, 4–6.

Type. Associated teeth; British Museum and Paris School of Mines.

Teeth with a few prominent large buttresses upon each long border, and all the crests ornamented with short transverse wrinkles.

An elaborate description of the dentition is given by Lohest (*loc. cit.*), who assigns *Agassizodus virginianus* to this species.

Form. & Loc. Lower Carboniferous (Ampélite): Belgium. (?) Upper Coal-Measures: West Virginia, U.S.A.

28754. Portion of type specimen described and figured by L. G. de Koninck, *op. cit.*; from the "Ampélite alunifère," Chockier, near Liége. *Purchased*, 1853.

The following species have also been founded upon teeth, but there are no examples in the Collection:—

Campodus corrugatus: *Orodus corrugatus*, Newberry & Worthen, Pal. Illinois, vol. iv. (1870), p. 358, pl. iii. fig. 18: *Agassizodus corrugatus*, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 323, pl. viii. fig. 24.—Lower Coal-Measures; Illinois. Upper Coal-Measures; Kansas.

Campodus rectangulus: *Arpagodus rectangulus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 59, pl. vi. fig. 12.—Carboniferous Limestone; Government of Moscow, Russia.

Campodus scitulus: *Agassizodus scitulus*, St. John & Worthen, *op. cit.* vol. vi. p. 322, pl. vi. figs. 16–18.—Lower Coal-Measures; Illinois. Middle Coal-Measures; Iowa.

Campodus variabilis: *Lophodus variabilis*, Newberry & Worthen, *op. cit.* vol. iv. p. 361, pl. iv. figs. 4, 5, 11: *Agassizodus variabilis*, St. John & Worthen, *op. cit.* vol. vi. p. 318, pl. viii. figs. 1–22.—Upper Coal-Measures; Illinois, Iowa, and Kansas.

Some Carboniferous Selachian teeth closely related to those of *Orodus* and *Agassizodus* have been described under the generic names of *Mesodmodus* (St. John & Worthen, Pal. Illinois, vol. vi. 1875, p. 290) and *Hybodopsis* (W. J. Barkas, Monthly Rev. Dental Surgery, vol. vii. 1878, p. 191). To the former are referred *Mesodmodus explanatus*, St. John & Worthen, *tom. cit.* p. 293, pl. v.

figs. 15-17, from the Kinderhook Limestone, Iowa; *M. exsculptus*, St. John & Worthen, *tom. cit.* p. 291, pl. v. fig. 18-22, from the same formation and locality; and *M. ornatus*, St. John & Worthen, *tom. cit.* p. 294, pl. v. figs. 12-14, from the Upper Burlington Limestone, Illinois and Iowa. To *Hybodopsis* is assigned only one species, *H. wardi*, W. J. Barkas, *tom. cit.* p. 191 (with figs.), founded upon a fragment of jaw in the collection of Mr. John Ward, of Longton, from the Coal-Measures of Burnley, Lancashire. In the original description of the latter the calcified cartilage-granules are referred to as shagreen, the actual shagreen-granules being much larger, flattened and elongated, with more or less transversely-disposed wrinkles.

Closely similar also are the Carboniferous teeth described under the names of *Leiodus*, St. John & Worthen[1] (Pal. Illinois, vol. vi. 1875, p. 335), *Desmiodus*, St. John & Worthen (*tom. cit.* p. 337), and *Chiastodus*, Trautschold (Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. 1879, p. 58).

To the first are assigned two species:—*Leiodus calcaratus*, St. John & Worthen, *tom. cit.* p. 336, pl. vii. figs. 11-18, from the Upper Burlington Limestone, Iowa and Illinois; and *L. grossipunctatus*, St. John & Worthen, *tom. cit.* p. 337, from the Keokuk Limestone, Iowa and Illinois. Some of these teeth are not much unlike a few Armagh specimens commonly referred to the so-called *Helodus appendiculatus*, M'Coy.

Desmiodus comprises four species, as follow:—*D. costelliferus*, St. John & Worthen, *tom. cit.* p. 341, pl. x.A. figs. 10, 11, from the Upper St. Louis Limestone, Illinois and Missouri; *D.*(?) *flabellum*, St. John & Worthen, *tom. cit.* p. 343, pl. x.A. fig. 15, from the Upper Keokuk Limestone, Missouri; *D.*(?) *ligoniformis*, St. John & Worthen, *tom. cit.* p. 342, pl. x.A. figs. 12-14, from the Upper Keokuk Limestone, Missouri and Iowa; and *D. tumidus*, St. John & Worthen, *tom. cit.* p. 339, pl. x.A. figs. 7-9, from the Upper St. Louis Limestone, Illinois and Missouri.

A single species is referred to *Chiastodus*, namely, *C. obvallatus*, Trautschold, *tom. cit.* p. 58, pl. vii. figs. 19-22. It is from the Carboniferous Limestone of Mjatschkowa, near Moscow.

[1] This name is preoccupied, *Leiodon* having been employed by Sir Richard Owen for a genus of Mosasaurian Reptiles (Odontogr. 1840-45, p. 261).

Genus **DICLITODUS**, Davis.

[Trans. Roy. Dublin Soc. [2] vol. i. 1883, p. 410.]

An indefinable Carboniferous genus, known only by the teeth, which are of very small size, narrow and elongated. The dental crown is elevated at each extremity and depressed mesially.

Diclitodus scitulus, Davis.

1883. *Diclitodus scitulus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. p. 410, pl. li. fig. 29.

1884. *Diclitodus scitulus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. p. 623, pl. xxvii. fig. 12.

Type. Detached tooth; Horne Collection, York Museum.

The single known species.

Form. & Loc. Upper Carboniferous Limestone: Yorkshire.

49629. Tooth; Richmond. *Purchased*, 1878.

P. 4890. More imperfect tooth; Yoredale Rocks, Wensleydale. *Horne Coll.*

P. 4891. Tooth on slab, with *Pleuroplax* and *Petalodus*; Wensleydale. *Horne Coll.*

Genus **SPHENACANTHUS**, Agassiz.

[Poiss. Foss. vol. iii. 1837, p. 23.]

Teeth moderately high, with a large principal coronal cusp, and smaller lateral cusps diminishing in size outwards, more or less marked by superficial wrinkles; root depressed, forming a slight expansion backwards. Dorsal fin-spines ornamented by robust longitudinal ridges, in part nodose; posterior denticles small, numerous, in two series, one upon each lateral margin of the flattened or slightly concave posterior face. Cephalic spines apparently absent[1]; shagreen sparse, consisting of minute comb-shaped granules.

Though the dorsal fin-spines of this fish are indistinguishable from those named *Ctenacanthus* by Agassiz, the absence in the Carboniferous Limestone of teeth generically identical with those just described indicates that the ichthyodorulites in question are common to more than one genus. The writer thus ventures to follow a

[1] The spine assigned to the head by J. Thomson (Trans. Geol. Soc. Glasgow, vol. iv. pt. i. 1871, p. 59, pl. iii. fig. 2) is evidently a dorsal spine of *Pleuracanthus*.

suggestion made, with hesitation, by Dr. Traquair, and adopt the provisional name of *Sphenacanthus* for the fish.

Sphenacanthus serrulatus, Agassiz.

1837. *Sphenacanthus serrulatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 24, pl. i. figs. 11–13.

1884. *Ctenacanthus* (?) *serrulatus*, R. H. Traquair, Geol. Mag. [3] vol. i. p. 6.

Type. Imperfect dorsal fin-spine; Edinburgh Museum.

The type species known only by the dorsal fin-spine, which attains a maximum length of about 0·15, and is ornamented by sharp ridges, in part sparsely nodose.

Form. & Loc. Calciferous Sandstones: Burdiehouse, near Edinburgh.

15506 *a*. Very imperfect spine; Burdiehouse. *Purchased.*

Sphenacanthus costellatus (Traquair).

1884. *Ctenacanthus costellatus*, R. H. Traquair, Geol. Mag. [3] vol. i. p. 3, pl. ii.

(?) 1888. *Ctenacanthus costellatus* (?), R. H. Traquair, *loc. cit.* vol. v. p. 81.

Type. Nearly complete fish; British Museum.

Crown of tooth with slender cusps almost or quite smooth. Ribs of the dorsal fin-spines ornamented with numerous finely-grooved tubercles.

Form. & Loc. Calciferous Sandstones: Dumfriesshire.

P. 5900. Type specimen, partly preserved in counterpart, described by R. H. Traquair, *loc. cit.*, 1884. *Purchased*, 1883.

Sphenacanthus hybodoides (Egerton).

1853. *Ctenacanthus hybodoides*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. ix. p. 280, pl. xii.

1853. *Ctenacanthus nodosus*, Sir P. Egerton, *ibid.* p. 281.

1869. *Ctenacanthus major*, J. Thomson, Brit. Assoc. Rep., Trans. Sect. p. 102.

1871. *Ctenacanthus hybodoides*, J. Thomson, Trans. Geol. Soc. Glasgow, vol. iv. pt. i. p. 59, pls. ii., iii.

1873. *Ctenacanthus* (? and *Cladodus*), T. P. Barkas, Coal-Meas. Palæont. p. 21, figs. 43–58 (? p. 19, figs. 31–34).

1874. *Hybodus*, W. J. Barkas, Geol. Mag. [2] vol. i. p. 163.

1875. *Ctenacanthus hybodoides*, J. Ward, [Proc.] N. Staffs. Nat. Field-Club, p. 215.

(?) 1878. *Hybodus davisi*, W. J. Barkas, Monthly Rev. Dental Surgery, vol. vii. p. 192.

1878. *Hybodus*, W. J. Barkas, Proc. Roy. Soc. N. S. Wales, vol. xi. p. 145.

Type. Dorsal fin-spine.

A species larger than either of the preceding, and not yet precisely defined. Crown of tooth robust and prominently striated; lateral denticles well developed. Ribs of the dorsal fin-spines generally smooth and rounded, sometimes in part nodose.

The dorsal fin-spines named by Egerton *Ctenacanthus hybodoides* and *C. nodosus* appear to the present writer to belong respectively to the anterior and posterior dorsal fins of the same fish. The nodose character of the superficial ornamental ridges varies greatly; in all the specimens examined from Staffordshire and Derbyshire the ridges are smooth.

Form. & Loc. Coal-Measures; Scotch Coal-field, Northumberland, Yorkshire, Derbyshire, Staffordshire, and N. Wales.

21422, 21975. Three teeth, one having a smooth principal cone; Carluke, Lanarkshire. *Purchased*, 1847.

P. 1322. Two teeth; Longton, Staffordshire. *Egerton Coll.*

P. 5234. Imperfect tooth; near Dudley, S. Staffordshire. *Purchased*, 1886.

36173. Supposed anterior dorsal fin-spine, with most of the ornamental ridges slightly nodose; Dalkeith, near Edinburgh. The posterior face is well shown, and also the extent of the posterior excavation. *Purchased*, 1862.

P. 2222. Three spines of similar proportions, with the ornamental ridges less nodose; Caudenfoot, Dalkeith. *Egerton Coll.*

P. 3123. Two imperfect associated spines, perhaps pertaining to the two dorsal fins of one fish; Dalkeith. The exserted portion of one specimen would probably measure 0·265 in length when complete, that of the other perhaps 0·305. Both are similarly ornamented, most of the superficial ridges being finely nodose; but the fossil is too imperfect to allow of the precise relative proportions of the spines being compared. *Enniskillen Coll.*

P. 3121. Type specimen of *Ctenacanthus nodosus*, Egerton; Dalkeith. *Enniskillen Coll.*

P. 2223. Four similar specimens; Dalkeith. *Egerton Coll.*

P. 3117–20, P. 3122. Five similar specimens; Dalkeith. *Enniskillen Coll.*

P. 3232. Imperfect small spine, the ornamental ridges not nodose; Lowmoor, Yorkshire. *Enniskillen Coll.*

P. 241. Fragment of small spine; Deep Mine, Longton, Staffordshire. *Weaver-Jones Coll.*

P. 5572. Nearly complete small spine; Tibshelf Colliery, near Alfreton, Derbyshire.
Presented by Edward Wilson, Esq., 1888.

Two fragmentary spines from the *Spirorbis*-Limestone (U. Coal-Measures) of Ardwick, Manchester (**41251** *a*. *Purchased*, 1869), are also referable to *Sphenacanthus*; and the following species have been founded upon detached spines, of which there are no examples in the Collection:—

Sphenacanthus aquistriatus: *Ctenacanthus aquistriatus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxv. (1879), p. 185, pl. x. fig. 15.—Lower Coal-Measures; Yorkshire.

Sphenacanthus minor: *Ctenacanthus minor*, J. W. Davis, Geol. Mag. [2] vol. vi. (1879), p. 531.—Lower Coal-Measures (Black-bed Coal); near Bradford, Yorkshire.

Another ribbed spine from the Carboniferous of Fermanagh, Ireland, evidently of a similar type, is named *Tristychius minor*, J. E. Portlock, Rep. Geol. Londonderry (1843), p. 464, pl. xiv. fig. 6; and a fragmentary fossil, from the Coal-Measures of South Wales, is referred to "*Byssacanthus?*" by J. W. Salter, Iron-Ores Gt. Britain, pt. iii. (Mem. Geol. Surv., 1861), p. 224, pl. i. fig. 21.

The fragmentary tooth from the Lower Carboniferous of Russia, named *Hybodus irregularis*, H. Romanowsky (Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 166, pl. iv. fig. 32), may belong either to *Sphenacanthus* or to *Cladodus*.

Genus **TRISTYCHIUS**, Agassiz.

[Poiss. Foss. vol. iii. 1837, p. 21.]

Syn. *Ptychacanthus*, L. Agassiz, *tom. cit.* 1837, p. 22.

Teeth not certainly identified, but probably resembling those of *Sphenacanthus* and *Hybodus*. Dorsal fin-spines with a few sharp longitudinal ridges distally, three only—one upon the front margin

and one on each side—extending far downwards; inserted portion not definitely separated from the exserted portion; posterior face narrow, concave, bounded by two prominent longitudinal edges, each with a series of large recurved denticles immediately within.

Though the spines of this genus were considered to be paired by T. Stock[1], the fish is now shown to be a typical Cestraciont (Hybodont) by R. H. Traquair[2].

Tristychius arcuatus, Agassiz.

1837. *Tristychius arcuatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 22, pl. i.*a*. figs. 9–11.
1837. *Ptychacanthus sublævis*, L. Agassiz, *tom. cit.* p. 23, pl. v. figs. 1–3 [3].
1883. *Tristychius arcuatus*, T. Stock, Ann. Mag. Nat. Hist. [5] vol. xii. p. 177, pl. vii.
1888. *Tristychius arcuatus*, R. H. Traquair, Geol. Mag. [3] vol. v. p. 83.
1889. *Tristychius arcuatus*, R. H. Traquair, *loc. cit.* [3] vol. vi. p. 27.

Type. Dorsal fin-spine; Anderson's College, Glasgow.
The single described species[4].
Form. & Loc. Lower Carboniferous: Scotch Coal-field.

42083. Imperfect spine; Calciferous Sandstones, Anstruther, Fifeshire. *Purchased*, 1870.

To *Tristychius* have also been doubtfully assigned[5] the teeth from the Coal-Measures of Wettin, Prussia, described under the names of *Hybodus carbonarius*, Giebel (Fauna Vorwelt, Fische, 1847, p. 313) and Germar (Verstein. Steinkohlengeb. Wettin. 1849, p. 71, pl. xxix. fig. 5), and *H. vicinalis*, Giebel (Fauna Vorwelt, Fische, p. 313) and Germar (*op. cit.* p. 72, pl. xxix. figs. 6, 7).

A number of small Carboniferous fossils, probably to be regarded as the dermal tubercles of some of the foregoing genera, have been described under the names of *Petrodus*, F. M'Coy (Ann. Mag. Nat. Hist. [2] vol. ii. 1848, p. 132), *Stemmatodus*, St. John & Worthen (Pal. Illinois, vol. vi. 1875, p. 328), and *Styracodus*, E. F. Germar (Verstein. Steinkohlengeb. Wettin, 1849, p. 70).

The bodies named *Petrodus* are conical and more or less circular in form, usually with a very thin root; the exserted portion is deeply furrowed, with rough radiating ridges, and its height does

[1] Ann. Mag. Nat. Hist. [5] vol. xii. (1883), p. 188.
[2] Geol. Mag. [3] vol. v. (1888), p. 83.
[3] This is considered to be the spine of the adult by Dr. R. H. Traquair.
[4] The supposed *T. fimbriatus*, Stock (*tom. cit.* p. 177, pl. vii. fig. 1), is founded upon a spine of a distinct genus, now named *Harpacanthus* (R. H. Traquair, Ann. Mag. Nat. Hist. [5] vol. xviii. p. 493).
[5] T. Stock, *tom. cit.* p. 183.

not exceed its maximum breadth. The fossil, in fact, is very similar to the dermal tubercles of *Hybodus* (Pl. VIII. figs. 2, 3), and though regarded as a tooth by M'Coy, L. G. de Koninck, and J. W. Davis, it may be reasonably assigned to the outer skin, as already suggested by Newberry & Worthen, Trautschold, and Lohest. In accordance with this determination, Trautschold proposes to substitute the name of *Ostinaspis* for that of *Petrodus*, as being more appropriate [1].

The following examples of *Petrodus* are comprised in the Collection:—

P. 2244. Two tubercles from the Carboniferous Limestone of Derbyshire, similar to those in the Woodwardian Museum, Cambridge, named *P. patelliformis*, M'Coy [2]. The exserted portion has a pointed apex, and the radiating ridges are about 13 or 14 in number, terminating at the base, very strong, sometimes dichotomously branching, and sometimes slightly marked by transverse sulci.
Egerton Coll.

46823 4. Six similar specimens, and piece of limestone exhibiting six others; Yoredale Rocks, near Todmorden, Lancashire.
Gilbertson Coll.

P. 2863. Three almost similar tubercles, of the form named *P. occidentalis*, Newberry & Worthen [3]; Coal-Measures, Belleville, Illinois. *Enniskillen Coll.*

P. 4734. Small example, with comparatively smooth ridges, referable to *P. barbotanus*, H. Romanowsky [4]; Carboniferous Limestone, Mjatschkowa, near Moscow, Russia.
Purchased, 1884.

P. 5855. Smoother tubercle; Yoredale Rocks, near Todmorden.
Presented by S. Barker, Esq., 1888.

P. 5116. Five larger specimens; Mjatschkowa. *Purchased*, 1886.

P. 4734 a. Two tubercles, oval in shape, not pointed, but with

[1] Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 298.

[2] Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 132, and Brit. Palæoz. Foss. (1855), p. 637, pl. 3 c, figs. 6–8; J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 400, pl. li. fig. 16; M. Lohest, Ann. Soc. Géol. Belg. vol. xi. (1883), p. 318, pl. iii. figs. 4–6, pl. v. fig. 1.

[3] Pal. Illinois, vol. ii. (1866), p. 70, pl. iv. figs. 15, 16.

[4] Bull. Soc. Imp. Nat. Moscou, 1864, pt. ii. p. 164, pl. iv. fig. 36; *Tubercule isolé d'une plaque de l'Asterolepis* (?), H. Romanowsky, *loc. cit.* p. 170; *Ostinaspis barbotana*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 298, pl. xxviii. fig. 12, *a–d*.

a short acute central crest, from which a few sharp simple ridges diverge; Mjatschkowa. These are very similar to *P. acutus*, Newberry & Worthen[1].

Purchased, 1884.

P. 5117. A similar, but more nearly perfect specimen; Mjatschkowa.

Purchased, 1886.

The following "species" of *Petrodus* are not represented in the Collection:—*P. coronatus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiv. (1879), p. 60, pl. vii. fig. 14 (*Ostinaspis*), from the Carboniferous Limestone of Mjatschkowa, near Moscow; *P.* (?) *pustulosus*, Newberry & Worthen, Pal. Illinois, vol. iv. (1870), p. 369, pl. ii. fig. 5, pl. iii. fig. 6, from the Burlington Limestone of Iowa; *P. ryckolti*, L. G. de Koninck, Faune Calc. Carbf. Belg. pt. i. (1878), p. 37, pl. v. fig. 12, from the Lower Carboniferous Limestone of Tournai, Belgium; and *P. simplicissimus*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), pl. xxviii. fig. 12, *g–i* (*Ostinaspis*), from the Carboniferous Limestone of Mjatschkowa.

The tubercles named *Stemmatodus*[2] are small clusters of sharp denticles. They occur in the English Coal-Measures, and are represented in the Collection by four specimens (Nos. **35000 1.** *Purchased*, 1860) from Fenton, North Staffordshire. From the American Lower Carboniferous the following "species" are distinguished:—*S. cheiriformis*, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 330, pl. viii. fig. 30, from the Burlington Limestone of Iowa; *S. bicristatus*, St. John & Worthen, *tom. cit.* p. 331, pl. viii. figs. 32, 33, 35, from Iowa; *S. bifurcatus*, St. John & Worthen, *tom. cit.* p. 330, pl. viii. fig. 31, from Iowa; *S. compactus*, St. John & Worthen, *tom. cit.* p. 334, pl. viii. fig. 38, from the Chester Limestone, Illinois; *S. keokuk*, St. John & Worthen, *tom. cit.* p. 334, from the Keokuk Limestone, Illinois and Iowa; *S. simplex*, St. John & Worthen, *tom. cit.* p. 332, pl. viii. figs. 36, 37, from Iowa; and *S. symmetricus*, St. John & Worthen, *tom. cit.* p. 333, pl. viii. fig. 28, from Iowa.

To *Styracodus* is referred one species, *S. acutus*, Giebel, sp. (Germar, Verstein. Steinkohlengeb. Wettin, 1849, p. 70, pl. xxix. fig. 3), from the Coal-Measures of Wettin, Prussia. It had previously been described as *Centrodus acutus*, Giebel (Fauna Vorwelt, Fische, 1847,

[1] Pal. Illinois, vol. ii. (1866), p. 72, pl. iv. fig. 17; (?) *Ostinaspis acuta*, H. Trautschold, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 299, pl. xxviii. fig. 12, *e*, *f*.

[2] This name is preoccupied, having been employed by Heckel for a Jurassic Pycnodont (Denkschr. math.-naturw. Cl. k. Akad. Wiss. Wien, vol. xi. 1856, p. 202).

p. 344), and is noticed by T. Stock, Ann. Mag. Nat. Hist. [5] vol. xii. p. 187, pl. vii. fig. 19.

A remarkable denticulated plate, from the Yoredale Rocks of Wensleydale, Yorkshire, perhaps also referable to the outer skin, is named *Echinodus paradoxus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. (1884), p. 631, pl. xxvii. fig. 7.

Genus **WODNIKA**, G. von Münster.

[Beitr. Petrefakt. vi. 1843, p. 48.]

Teeth of large size, all adapted for crushing; coronal surface smooth and gently rounded. Symphysial teeth few. Dorsal fin-spines longitudinally ridged and grooved, the ridges few and relatively large.

Wodnika althausi (Münster).

1840. *Acrodus althausii*, G. von Münster, Beitr. Petrefakt. iii. p. 123, pls. iii. & iv. fig. 6, pl. viii. fig. 5.
1840. *Strophodus arcuatus*, G. von Münster, *op. cit.* iii. p. 123, pls. iii. & iv. fig. 7, pl. viii. fig. 11.
1843. *Strophodus arcuatus*, G. von Münster, *op. cit.* vi. p. 50, pl. i. fig. 3.
1843. *Wodnika striatula*, G. von Münster, *op. cit.* vi. p. 48, pl. i. fig. 1.
1843. *Strophodus angustus*, G. von Münster, *op. cit.* vi. p. 51.
1861. *Wodnika striatula*, H. B. Geinitz, Dyas, p. 26, pl. v. figs. 5–7.

Type. Detached teeth; Munich Museum.
The single known species.
Form. & Loc. Upper Permian (Kupferschiefer): Thuringia.

38591. About ten associated teeth; Riechelsdorf. *Purchased*, 1864.

43423. Portion of jaws showing some of the principal teeth and the two series immediately in advance; Riechelsdorf.
Presented by Kenneth Murchison, Esq., 1872.

P. 2774. Some of the teeth of three postero-lateral series in natural order; Riechelsdorf. *Enniskillen Coll.*

Genus **PALÆOBATES**, H. von Meyer.

[Palæontogr. vol. i. 1849, p. 234.]

A very imperfectly known genus, the species of small size. Teeth with low crowns, not longitudinally keeled, without lateral denticles; coronal surface coarsely punctate, almost reticulated. Principal teeth elongated, flat or gently rounded; anterior teeth slightly elevated, obtuse, of relatively large size.

Though not entirely appropriate in significance, this name may be provisionally retained for the Triassic Selachians with teeth much resembling those termed *Strophodus*—no dorsal fin-spines with tubercular ornament having hitherto been discovered in the Trias, and other facts suggesting the generic distinctness of the fish in question.

Palæobates angustissimus (Agassiz).

1837. *Psammodus angustissimus*, H. B. Geinitz (*ex* Agassiz, MS.), Beitr. Kennt. Thüring. Muschelkgeb. p. 22, pl. iii. figs. 6, 7.
1838. *Strophodus angustissimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 128, pl. xviii. figs. 28–30.
(?) 1838. *Strophodus elytra*, L. Agassiz, *tom. cit.* p. 128 *b*, pl. xviii. fig. 31.
1849. *Palæobates angustissimus*, H. von Meyer, Palæontogr. vol. i. p. 233, pl. xxviii. figs. 14, 15.
1861. *Palæobates angustissimus*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 8, pl. i. figs. 4–15.
1861. *Palæobates ovalis*, E. E. Schmid, *loc. cit.* p. 9, pl. i. figs. 16 24[1].
1861. *Palæobates acrodiformis*, E. E. Schmid, *loc. cit.* p. 9, pl. i. figs. 25–27.
(?) 1861. *Palæobates angustus*, E. E. Schmid, *loc. cit.* p. 7, pl. i. figs. 1–3.
1865. *Strophodus angustissimus*, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, p. 62.

Type. Detached teeth.

Scarcely yet definable. Principal teeth very long and narrow with rounded extremities.

As already recognized by Eck, the supposed specific differences between three of the forms of teeth described by Schmid correspond merely with differences of situation in the jaw. Agassiz's *Strophodus elytra* and Schmid's *Palæobates angustus* may be distinct, but cannot yet be definitely separated.

Form. & Loc. Muschelkalk: Silesia, Thuringia, Bavaria, Würtemberg, Saxe-Weimar, Alsace-Lorraine, and Eastern France. Upper Bunter: Rhenish Bavaria.

P. 5563. Two elongated teeth; Upper Muschelkalk, Beuthen, Silesia. *Purchased*, 1888.

1115–6. Two moderately elongated teeth, and one anterior tooth; Laineck, near Bayreuth, Bavaria. *Braun Coll.*

P. 2666. Elongated tooth, the crown slightly raised towards one extremity; Laineck. *Enniskillen Coll.*

[1] Another tooth from the Muschelkalk, probably of *Palæobates*, is named *Strophodus ovalis*, C. G. Giebel, Fauna d. Vorw., Fische (1847), p. 330.

P. 2122. Imperfect narrow tooth; Jena. *Egerton Coll.*

28476 *a*. Three imperfect elongated teeth, and one from a more anterior situation; Crailsheim, Würtemberg. *Purchased*, 1853.

P. 2667. Abraded elongated tooth; Crailsheim. *Enniskillen Coll.*

P. 2129. Two anterior teeth; Würtemberg. *Egerton Coll.*

Genus **HYBODUS**, Agassiz.

[Poiss. Foss. vol. iii. 1837, p. 41.]

Syn. *Sphenonchus*, L. Agassiz, *tom. cit.* 1843, p. 201 (in part).
(?) *Meristodon*, L. Agassiz, *tom. cit.* 1843, p. 286.
(?) *Selachidea*, F. A. Quenstedt, Handb. Petrefakt. 1852, p. 173.

Teeth conical or cuspidate, the crown more or less striated, with one principal elevation, and one or more lateral prominences on either side diminishing outwards; root much or moderately depressed. Symphysial teeth few, relatively large. Dorsal fin-spines longitudinally ridged and grooved, the ridges not denticulated; two posterior longitudinal series of denticles, not marginal, but placed together mesially. Anterior dorsal spine longer and more slender than the posterior. Shagreen sparse, consisting of small conical, radiately-grooved tubercles, sometimes fused into groups of three. Two large hook-shaped, semi-barbed dermal spines immediately behind each orbit. Notochord persistent.

It will be convenient to arrange the species of this genus in stratigraphical order, the detached teeth from some horizons being doubtfully placed here until the discovery of more satisfactory specimens.

The dorsal fin-spines do not appear to afford constant specific characters, and all determinations attempted below must thus be regarded as provisional.

Hybodus plicatilis, Agassiz.

1837. *Hybodus plicatilis*, H. B. Geinitz (*ex* Agassiz, MS.), Beitr. Kennt. Thüring. Muschelkalkgeb. p. 22, pl. iii. fig. 8.
1843. *Hybodus plicatilis*, L. Agassiz, Poiss. Foss. vol. iii. p. 189, pl. xxii. *a*. fig. 1, pl. xxiv. figs. 10, 13.
(?) 1843. *Hybodus longiconus*, L. Agassiz, *tom. cit.* p. 191, pl. xxiv. figs. 19–21, 23 (*non* fig. 22).
1844. *Hybodus plicatilis*, H. von Meyer & T. Plieninger, Beitr. Pal. Württembergs, p. 111, pl. xii. figs. 51, 70, 71.
1844. *Hybodus longiconus*, H. von Meyer & T. Plieninger, *op. cit.* p. 56, pl. xii. figs. 54, 56.

1849. *Hybodus plicatilis*, H. von Meyer, Palæontogr. vol. i. p. 224, pl. xxviii. figs. 35, 36, 40.

1849. *Hybodus mougeoti*, H. von Meyer, *tom. cit.* p. 225, pl. xxviii. fig. 37.

1849. *Hybodus obliquus*, H. von Meyer, *tom. cit.* p. 227, pl. xxviii. fig. 41.

(?) 1849. *Hybodus longiconus*, H. von Meyer, *tom. cit.* p. 227, pl. xxviii. fig. 39.

1852. *Hybodus plicatilis*, P. Gervais, Zool. et Pal. Franç., Explic. Pl., Poissons Foss. p. 12, pl. lxxvii. fig. 3 (*non* figs. 1, 2, 4, 5).

1856. *Hybodus plicatilis*, C. Giebel, Zeitschr. gesammt. Naturw. vol. viii. p. 426, pl. i. fig. 6.

1857. *Hybodus plicatilis*, C. Chop, Zeitschr. gesammt. Naturw. vol. ix. p. 128.

1861. *Hybodus plicatilis*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 18, pl. iii. figs. 7–12 (*non* figs. 1–6).

1865. *Hybodus plicatilis*, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, p. 65.

1865. *Hybodus longiconus*, H. Eck, *op. cit.* p. 119 (in part).

1870. *Hybodus plicatilis*, F. Roemer, Geol. von Oberschlesien, pl. xii. figs. 13, 14.

1883. *Hybodus plicatilis*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. xi. p. 495, pl. xii. figs. 6–11.

Type. Detached teeth.

Teeth small, with a relatively high crown, strongly marked by vertical superficial wrinkles. The lateral denticles are two, three, or four in number on each side, well separated, elongate, and slender.

Detached teeth only being known, it is impossible at present to determine the precise characters of the dentition of this species. The teeth named *H. longiconus*, Agass., may almost certainly be referred to the symphysial portion of the jaw; and Sauvage (*loc. cit.*) is inclined to think that *H. angustus*, Agass., is founded upon posterior teeth of this species. Schmid (*loc. cit.*) also proposes to include Agassiz's *H. mougeoti*, *H. angustus*, *H. polycyphus*, *H. obliquus*, *H. cuspidatus*, *H. sublævis*, and *H. apicalis*. Without a larger number of specimens, however, it does not appear justifiable to extend the synonymy beyond that given above.

Form. & Loc. Muschelkalk: Upper Silesia, Bavaria, Würtemberg, Brunswick, Thuringia, Saxe-Weimar, Lorraine, and Eastern France.

28464. Small posterior tooth; Bayreuth, Bavaria. *Purchased*, 1853.

1533. Similar tooth; Bayreuth. *Braun Coll.*

P. 2769, P. 2775. Two typical teeth, and one resembling *H. longiconus*, Agass.; Bayreuth. *Enniskillen Coll.*

P. 2179, P. 2180, P. 2191. Six teeth, three being of the form of *H. longiconus*, and showing lateral denticles; Bayreuth. *Egerton Coll.*

P. 2770, P. 2770 a. Three teeth, and one large tooth either of this species or *H. mougeoti*; Brunswick. *Enniskillen Coll.*

Hybodus mougeoti, Agassiz.

1843. *Hybodus mougeoti*, L. Agassiz, Poiss. Foss. vol. iii. p. 190, pl. xxiv. figs. 7, 8, 11, 12, 16.
1843. *Hybodus obliquus*, L. Agassiz, *tom. cit.* p. 192, pl. xxiv. figs. 3–6 (*non* figs. 1, 2).
1844. *Hybodus obliquus*, H. von Meyer & T. Plieninger, Beitr. Pal. Württembergs, p. 56, pl. xii. fig. 58.
1844. *Hybodus* (*obliquus*, Ag. ?) *aduncus*, Plieninger, in H. von Meyer & T. Plieninger, *op. cit.* p. 112, pl. xii. figs. 55, 88.
(?) 1844. *Hybodus aduncus*, Plieninger, in H. von Meyer & T. Plieninger, *op. cit.* p. 112, pl. xii. figs. 26, 35, 80.
1852. *Hybodus plicatilis*, P. Gervais, Zool. et Pal. Franç. Explic. Pl. Poiss. Foss. p. 12, pl. lxxvii. figs. 1, 2, 4 (*non* fig. 3).
1856. *Hybodus mougeoti*, C. Giebel, Zeitschr. gesammt. Naturw. vol. viii. p. 426, pl. i. fig. 7.
1861. *Hybodus plicatilis*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 19, pl. iii. figs. 1–6.
1865. *Hybodus mougeoti*, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, p. 118.
1883. *Hybodus mougeoti*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. xi. p. 495, pl. xii. fig. 12.

Type. Detached teeth.

Teeth very robust, with a relatively high crown, strongly marked by numerous vertical superficial wrinkles. Lateral denticles small, robust, sometimes absent.

Some of the teeth referred to this species do not differ much from those of *H. plicatilis*, but we follow Sauvage in regarding it as distinct.

Form. & Loc. Muschelkalk and Lettenkohl: Bavaria, Würtemberg, Hanover, and Eastern France.

1534–5. Two small teeth, and one larger; Bayreuth, Bavaria. *Braun Coll.*

19684. Large tooth, with worn or abraded principal cone: Bayreuth. *Purchased*, 1845.

P. 2180 a. Typical tooth; Bayreuth. *Egerton Coll.*

P. 2782. Tooth, with worn or abraded principal cone; Hildesheim, Hanover. *Enniskillen Coll.*

28479. Three tooth-fragments, perhaps of this species; Crailsheim, Würtemberg. *Purchased*, 1853.

P. 2179. Similar fragment; Crailsheim. *Egerton Coll.*

Hybodus polycyphus, Agassiz.

1843. *Hybodus polycyphus*, L. Agassiz, Poiss. Foss. vol. iii. p. 193, pl. xxiv. figs. 17, 18.
1843. *Hybodus longiconus*, L. Agassiz, *tom. cit.* pl. xxiv. fig. 22.
1844. *Hybodus rugosus*, T. Plieninger in H. von Meyer & T. Plieninger's Beitr. Pal. Württembergs, pp. 56, 117, pl. xii. figs. 52, 59.
1849. *Hybodus mougeoti* and *H. plicatilis*, H. von Meyer, Palæontogr. vol. i. p. 226, pl. xxviii. figs. 46–48.
1852. *Hybodus rugosus*, F. A. Quenstedt, Handb. Petrefakt. p. 177, pl. xiii. fig. 29.
1865. *Hybodus polycyphus*, H. Eck, Form. bunt. Sandst. u. Muschelk. Ober-schlesien, p. 119.

Type. Detached teeth.

Teeth very thick and robust, with a moderately elevated crown. Coronal surface mostly smooth, with rugose markings extending downwards from the summit of the principal cone, and also from the summit of the stout lateral denticles.

Form. & Loc. Muschelkalk and Lettenkohl: E. France, Würtemberg, Saxony, and Silesia.

28476. Three broken teeth; Bone-bed, Crailsheim. *Purchased*, 1853.

P. 2189. Imperfect tooth; Crailsheim. *Egerton Coll.*

P. 2790. Similar specimen; Crailsheim. *Enniskillen Coll.*

28481. Tooth; Halle, Saxony. *Purchased*, 1853.

Hybodus cuspidatus, Agassiz.

1843. *Hybodus cuspidatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 194, pl. xxii. *a*. figs. 5–7.
1844. *Hybodus cuspidatus*, H. von Meyer & T. Plieninger, Beitr. Pal. Württembergs, p. 113, pl. xii. figs. 57, 61, 62.
1882. *Hybodus robustus*, F. A. Quenstedt, Handb. Petrefakt. 3rd edit. p. 277, pl. xxi. fig. 31.

Type. Detached teeth.

Teeth with a relatively high conical crown, strongly marked by vertical superficial wrinkles. Lateral denticles robust and conical.

Form. & Loc. Upper Muschelkalk and Keuper: Würtemberg.

28465. Imperfect tooth; Ludwigsburg. *Purchased*, 1853.

19691. Tooth fragment; Würtemberg. *Purchased*, 1845.

Hybodus apicalis, Agassiz.

1843. *Hybodus apicalis*, L. Agassiz, Poiss. Foss. vol. iii. p. 195, pl. xxiii. figs. 16–20.

Type. Detached teeth.

Teeth very minute, with a high crown, the principal cone tapering to a very sharp point.

Form. & Loc. Lettenkohl: Hanover.

P. 2190. Three broken teeth; Hildesheim. *Egerton Coll.*

Hybodus minor, Agassiz.

1837. *Hybodus minor*, L. Agassiz, Poiss. Foss. vol. iii. p. 48, pl. viii. *b.* figs. 2, 3 (spine).

1843. *Hybodus minor*, L. Agassiz, *tom. cit.* p. 183, pl. xxiii. figs. 21–24 (teeth).

1844. *Hybodus minor*, H. von Meyer & T. Plieninger, Beitr. Pal. Württembergs, p. 109, pl. xii. fig. 28.

1872. *Hybodus minor*, R. Etheridge, Proc. Cardiff Naturalists' Soc. vol. iii. pl. ii. figs. 12–14.

Type. Dorsal fin-spine; Bristol Museum. Teeth; British Museum.

A relatively small species. Teeth with a high crown, much resembling *H. apicalis*, but having the principal cone more slender and less sharply pointed. Lateral denticles 1–3, robust, and the coronal superficial wrinkles prominent. Base depressed, flattened, expanded posteriorly.

Upon the dorsal fin-spines, referred by Agassiz to the same species, the longitudinal ridges are rounded, strong, and of approximately equal size; the posterior face is slightly convex, and the denticles large. Some of these spines, however, must pertain to *Acrodus minimus*.

Form. & Loc. Rhætic: Somersetshire, Gloucestershire, Devonshire, Leicestershire, and Würtemberg.

P. 2783–4. Teeth described and figured by Agassiz, *tom. cit.* p. 183, pl. xxiii. figs. 23, 24; Axmouth, Devonshire. *Enniskillen Coll.*

P. 2786, P. 2789. Fourteen detached teeth; Axmouth. *Enniskillen Coll.*

P. 2771. One tooth labelled *H. plicatilis* by Agassiz; Axmouth. *Enniskillen Coll.*

P. 2194. Two detached teeth; Axmouth. *Egerton Coll.*

P. 2788. Tooth associated with fragment of cephalic dermal spine (*Sphenonchus*); Axmouth. *Enniskillen Coll.*

P. 2193 a. Tooth; Aust Cliff, near Bristol. *Egerton Coll.*

P. 5338. Seven teeth detached from matrix; Aust Cliff.

P. 2787. Fragment of Aust bone-bed, with two large teeth, a small broken cephalic spine, and a fragment of the dorsal spine. *Enniskillen Coll.*

19692. Anterior tooth; Würtemberg. *Purchased*, 1845.

Of the following dorsal fin-spines, the majority doubtless pertain to *Hybodus minor*, but some almost certainly to *Acrodus minimus*:—

P. 3169. Incomplete slender spine; Aust Cliff. *Enniskillen Coll.*

P. 2176. Imperfect dorsal spines; Aust Cliff. *Egerton Coll.*

34986. Two portions of dorsal spines, showing posterior denticles; Aust Cliff. *Purchased*, 1860.

41293. Abraded dorsal spine; Aust Cliff. *Purchased*, 1869.

24840. Two much broken dorsal spines; Aust Cliff. *Purchased*, 1850.

P. 430. Imperfect dorsal spine; Axminster. *Purchased*, 1882.

Hybodus lawsoni, Duff.

1842. *Hybodus lawsoni*, P. Duff, Geol. Moray, pp. 61, 63, pl. iv. figs. 1, 2, 5, 6.

(?) 1842. Tooth of *Sphenonchus*, P. Duff, *op. cit.* p. 63, pl. iv. fig. 11.

1843. *Hybodus dubius*, L. Agassiz, Poiss. Foss. vol. iii. p. 188, pl. xxii. *a.* figs. 8–10.

(?) 1843. *Sphenonchus martini*, L. Agassiz, *tom. cit.* p. 203, pl. xxii. *a.* figs. 15–17.

Type. Dorsal fin-spines and teeth.

A small species. Teeth with a high crown, the principal cone long, slender, and pointed, and at least one well-separated lateral cone on each side; coronal surface strongly wrinkled. Base of tooth slightly expanded posteriorly.

Form. & Loc. Rhætic: Linksfield, near Elgin, Scotland[1].

P. 2174. Two teeth. *Egerton Coll.*

P. 2174 a. A small, abraded dorsal spine, and fragment of a larger specimen. *Egerton Coll.*

[1] A tooth from the Wealden of Hanover is referred to *H. dubius*, Agass., by C. Struckmann, Wealden-Bild. Umgegend Hannover, 1880, p. 92, pl. iii. fig. 10.

P. 2839. Imperfect large dorsal spine. *Enniskillen Coll.*

34992–3. Two fragments of spines. *Purchased*, 1860.

Hybodus cloacinus, Quenstedt.

1858. *Hybodus cloacinus*, F. A. Quenstedt, Der Jura, p. 34, pl. ii. fig. 15.
1872. *Hybodus reticulatus*, R. Etheridge, Proc. Cardiff Naturalists' Soc. vol. iii. pl. ii. fig. 11.
(?) 1881. *Hybodus austiensis*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. p. 416, pl. xxii. fig. 1.

Type. Detached tooth; Tübingen Museum.

Teeth narrow and much laterally elongated: the principal coronal eminence slender and bluntly pointed, its height not equalling half the length of the tooth; lateral cones short, blunt, 3–4 on each side; superficial coronal wrinkles large, generally few and widely spaced, but variable. Root not expanded posteriorly.

Form. & Loc. Rhætic: Würtemberg, Somersetshire, Gloucestershire, and Devonshire. (?) Lower Lias: Lyme Regis, Dorsetshire.

23153 *a*. Three fragments of teeth; Aust Cliff, near Bristol. *Purchased*, 1849.

P. 2193. Five teeth; Aust Cliff. *Egerton Coll.*

P. 2776–7. Two imperfect teeth; Aust Cliff. *Enniskillen Coll.*

P. 5100. Tooth; Garden Cliff, Westbury-on-Severn. *Presented by J. E. Lee, Esq.*, 1885.

P. 2771. Small tooth; Axmouth, Devonshire. *Enniskillen Coll.*

The following dorsal fin-spines are of the form described by J. W. Davis (*loc. cit.*) as *H. austiensis*, and, on account of their size, may be provisionally assigned to *H. cloacinus*. The lower portion of the posterior face appears to exhibit a more prominent longitudinal eminence than in the spines assigned to *H. minor*.

36165. Abraded middle portion of spine; Aust Cliff. *Johnson Coll.*

P. 2177. Two imperfect abraded spines; Aust Cliff. *Egerton Coll.*

P. 2778. A slightly crushed spine, wanting the extremity of the base; Aust Cliff. The exserted portion measures about 0·185 in length, and exhibits large posterior denticles much abraded, as in the specimen figured by Davis, *loc. cit.* *Enniskillen Coll.*

P. 2779. Incomplete exserted portion of a slightly larger spine; Aust Cliff. *Enniskillen Coll.*

There is still some doubt as to the propriety of assigning the following specimens to *H. cloacinus*, but the teeth seem to agree most closely with those of this species:—

P. 2196. Crushed remains of the head and dentition, four of the teeth shown, of the natural size, in Pl. X. figs. 10–14; Lower Lias, Lyme Regis. Most of the teeth preserved are referable to the principal lateral rows, and are scarcely distinguishable in form from the typical teeth of *H. cloacinus*. The superficial coronal wrinkles are numerous in all but few examples, and they are sometimes more closely arranged and prominent on one side of the crown than on the other. *Egerton Coll.*

39785. Small group of anterior teeth, two shown, of the natural size, from the posterior and anterior aspect respectively, in Pl. X. figs. 8, 9; Lyme Regis. *Purchased*, 1862.

Hybodus raricostatus, Agassiz.

1843. *Hybodus raricostatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 187, pl. xxiv. fig. 24.

Type. Detached tooth; Bristol Museum.

Teeth with a relatively low crown, the median eminence broad and pointed, and all the lateral cones and the longitudinal crest acute; superficial coronal wrinkles generally few, though variable. The hinder lateral teeth are much elongated, with the sharply-pointed coronal cusps partially fused together, and the longitudinal acute crest especially prominent.

This species appears to be intermediate between *H. cloacinus* and *H. delabechei*, and it is scarcely possible to distinguish some of the teeth from those of the latter species.

Form. & Loc. Lower Lias: Lyme Regis, Dorsetshire[1].

43972. A group of very large postero-lateral teeth, many with few and insignificant coronal wrinkles. Several of the teeth are more elongated than any met with in *H. delabechei*. *Purchased*, 1872.

P. 2800. Half of a naturally-arranged transverse series of seven large teeth, with few coronal wrinkles, cut across the median apices, and the section polished. *Enniskillen Coll.*

[1] A fragmentary tooth, not of *H. raricostatus*, is described under this name by K. Fricke, Palæontogr. vol. xxii. (1875), p. 393, pl. xxi. fig. 20.

P. 2798. Group of postero-lateral teeth, and shagreen.
Enniskillen Coll.

P. 2796. Portions probably of the three hinder series of teeth (nos. VII. to IX.), with very low crowns, shown, of the natural size, in Pl. X. fig. 15. In the teeth of the small terminal row the longitudinal crest gradually rises to a median eminence, and there are only faint indications of one or two lateral points on each side. The teeth of the second row are more than three times as long as these, and the principal eminence, which is narrow and pointed, is placed at about one third of the length of the crown from its anterior extremity; the lateral cusps vary in their relative prominence, and are three or four in number anteriorly and about eight posteriorly. The third series of teeth is too imperfect for description, but there is distinct evidence that the median coronal elevation is much larger than in the series behind. The number and proportions of the superficial wrinkles upon the crown vary considerably, but they are often sparse and delicate.
Enniskillen Coll.

The following small specimens are not certainly determinable, but may pertain to young individuals of this species:—

P. 2797. Obscure remains of the jaws, branchial arches, and other cartilages, with the scattered dentition, and part of a "*Sphenonchus*." Two of the teeth are shown, of the natural size, in Pl. X. figs. 6, 7, and they are all remarkable for the fewness and prominence of the coronal wrinkles. *Enniskillen Coll.*

P. 3168. The crushed head and anterior portion of the trunk of a small Hybodont, probably to be regarded as a young individual. The skull must have originally measured about 0·08 in length; and the first dorsal fin-spine attains a total length of 0·095, inserted at a distance of about 0·2 from the end of the snout. The remains of the head are exposed from below, displaying the characteristic basi-occipital region of the cranium and portions of the mandibular and hyoid arches, with a few scattered teeth. The right ceratohyal is shown, slightly curved, very broad and large, attaining a length of about 0·06; but the precise outlines of the other elements are obscured. The teeth exhibited have sharp, broad, coronal cusps,—one principal,

placed more or less mesially, with two or three smaller cusps on either side; the superficial coronal wrinkles are few and large, and the base of the tooth in each case is somewhat depressed. Portions of the branchial apparatus are preserved, but the number and proportions of the arches cannot be determined. Still more posteriorly are to be observed the two long slender halves of the pectoral arch, tapering above: each division measures about 0·1 in length, but it cannot be determined whether they were united ventrally. The dorsal fin-spine is not much broken; the base is about equal in size to the exserted part; the posterior denticles are very large; and the lateral ornamental ribs are few, widely spaced, and sharp. In these characters the spine much resembles that named by Agassiz *H. crassispinus*. *Enniskillen Coll.*

11262, 11282. Two groups of small low-crowned teeth, with the cusps slightly oblique, bearing the MS. name of *Hybodus homopryon*, Agassiz. *Mantell Coll.*

Hybodus delabechei, Charlesworth.

1839. *Hybodus delabechei*, E. Charlesworth, Mag. Nat. Hist. n. s. vol. iii. p. 242, pl. iv.

1843. *Hybodus pyramidalis*, L. Agassiz, Poiss. Foss. vol. iii. p. 182, pl. xxii. *a*. figs. 20, 21.

1865. *Hybodus delabechei*, E. C. H. Day, Geol. Mag. vol. ii. p. 565.

Type. Imperfect head associated with dorsal fin-spines.

Teeth with a relatively low crown, the median eminence large and prominent, conical or pyramidal, with two, three, or four small lateral cones of similar form; superficial coronal wrinkles numerous, acute. The median coronal eminence is relatively the largest and broadest in the principal lateral teeth; and both it and the lateral cones are narrowest and highest in the symphysial teeth. The hindermost lateral teeth are small, very low, long, and narrow, and have the cones rounder than in other parts of the dentition.

The type specimen of *H. pyramidalis* appears to have been described only from the drawing, which is misleading, inasmuch as it does not exhibit the considerable variations of the teeth in the associated group.

Form. & Loc. Lower Lias: Lyme Regis, Dorsetshire.

39880. Crushed head and anterior portion of the trunk, exhibiting the shagreen, cephalic spines, and a few teeth, shown, of

one-third the natural size, in Pl. VIII. fig. 1, and already briefly noticed by E. C. H. Day, *loc. cit.* The parts are much disturbed, and the thick covering of shagreen obscures the internal skeleton; but there is the appearance of a blunt rounded snout, and the position of the right orbit (*orb.*) is distinguishable. A few teeth are seen bordering the lower margin of the right pterygo-quadrate cartilage, and these are of the ordinary type characterizing the species. The left pterygo-quadrate (*ptq.*) is displaced upwards. The shagreen-granules (Pl. VIII. figs. 2–5) are conical in shape, with ridges and deep furrows diverging from the apex, and with a well-defined base; being, indeed, very suggestive of the small Carboniferous fossils named *Petrodus*. These granules are largest upon the top of the head (figs. 2, 3), and are especially conspicuous between, and immediately in advance of, the orbits: they are much smaller behind the head, and tend towards fusion into small groups of three (figs. 4, 5). Their relative proportions are shown by the figures, which are all drawn of three times the natural size. Behind the orbit on the right side, and on the same level as this aperture, are fixed two large recurved semi-barbed spines, upon triradiate bases (fig. 1 *c.s.*^{1}, *c.s.*^{2}), which have already been recognized by Charlesworth and Day as identical with the supposed teeth described by Agassiz under the name of *Sphenonchus*. Though probably slightly displaced, these appendages have the appearance of being almost in their natural position; and the corresponding spines are seen upon the left side. Each of the anterior pair has two protuberances at the base of the "crown," while in the posterior pair these are absent. *Purchased*, 1866.

P. 3159. Remains of a larger fish, comprising cartilage-fragments of the head and appendicular skeleton, two broken cephalic spines, the imperfect dorsal spines, and shagreen.
Enniskillen Coll.

P. 3160. Crushed skull and mandible, side view, showing a portion of the displaced dentition and traces of shagreen, associated with other fragments of cartilage, and the two dorsal fin-spines. *Enniskillen Coll.*

P. 3161. Remains of the left mandibular, pterygo-quadrate, and other cartilages, with the scattered dentition and traces of shagreen. The specimen has been broken across the middle

of the head, and the anterior fragment somewhat misplaced, a small intermediate portion in the upper part of the fracture being wanting. *Enniskillen Coll.*

40352. Imperfect remains of the skull and mandible and other cartilages, with part of the slightly scattered dentition, shagreen, and three of the "*Sphenonchi*." *Purchased*, 1867.

P. 3171. Imperfect left mandibular and pterygo-quadrate cartilages, and other fragments, with a few broken teeth. *Enniskillen Coll.*

35792. Fragment of cartilage and teeth. *Purchased*, 1860.

P. 2781. Remains of cartilage, shagreen, and a few large teeth, in very hard matrix, identical in character with that of the next specimen. *Enniskillen Coll.*

20570. Group of displaced teeth, forming the type specimen of *H. pyramidalis*, Agassiz. As remarked above, the teeth exhibit much variation in size and form, and four are shown, of the natural size, in Pl. X. figs. 1–4. Only a few have the median eminence relatively so large as indicated in the figure in the 'Poiss. Foss.' *Johnson Coll.*

P. 2795. A broken small slab of Lias, showing about seventy teeth, some in their natural relative positions. Those originally occupying the middle of the side of the jaw measure 0·023 in their long diameter, while those at the symphysis only have a corresponding measurement of about 0·015. In the latter, the coronal cusps are relatively high, and the large fibrous base is very broad. *Enniskillen Coll.*

P. 2791. Teeth of the four hindermost series in the jaw, arranged in their original relative positions, and shown, of the natural size, in Pl. X. fig. 5. The teeth of the third row preserved (*b*) are very similar to the imperfect example from the type specimen of *H. pyramidalis* figured in Pl. X. fig. 4, and those of the second row also resemble one of the last-named fossil. There can thus be little doubt as to the specific determination of the present specimen. As shown in side view (figs. 5 *a*–*c*), the coronal cusps are less elevated and more rounded than those of the more anteriorly placed teeth. *Enniskillen Coll.*

P. 2799. Portions of four series of teeth, naturally arranged, with fragments of cartilage and shagreen. *Enniskillen Coll.*

P. 2198. Fossil of a very similar character to the preceding, but showing more anterior teeth. *Egerton Coll.*

20600. A scattered group of teeth. *Johnson Coll.*

20600 a. Small group of naturally arranged principal teeth, much abraded and broken. *Johnson Coll.*

18989. Group of about twenty teeth. *Purchased*, 1854.

P. 4174. A few scattered teeth, associated with two broken cephalic spines. *Enniskillen Coll.*

32750. Group of small teeth. *Purchased*, 1857.

39148. Seven associated teeth. *Bowerbank Coll.*

40092. Four teeth. *Purchased*, 1866.

P. 2201–2. Four teeth. *Egerton Coll.*

P. 2203. Four groups of teeth, either of this species or of *H. varicostatus*. *Egerton Coll.*

P. 2793. Seven teeth. *Enniskillen Coll.*

P. 2791 a. Group of small teeth, partly arranged in natural series, probably referable to the young or a small individual of this species. *Enniskillen Coll.*

39784. Group of small teeth. *Purchased*, 1862.

38103. Large group of scattered small teeth, including some from the hindermost rows, associated with a few small fragments of cartilage, shagreen, and portions of two "*Sphenonchi*." This specimen may be referred, without much hesitation, to the young of the present species *Purchased*, 1864.

38127. Teeth and first dorsal fin-spine of a still smaller fish, either of this species or *H. medius*. *Purchased*, 1864.

It is impossible at present to distinguish the dorsal fin-spines of *H. delabecheï* from those of *H. medius* and *H. varicostatus*, and they are therefore provisionally grouped together below. The dorsal spine of *H. delabecheï* is shown in No. P. 3160, and that of *H. medius* in No. P. 340; that of *H. varicostatus* is still unrecognized. The spine is robust, and the lateral ribs very numerous and closely

arranged, sharp distally, rounder and more nodose proximally; the denticles are very large, placed upon a longitudinal elevation of the posterior face.

42512. Two much abraded spines of one individual, free from matrix. The posterior face exhibits the median longitudinal elevation; and the exserted portion of the first measures 0·355 in length, that of the second 0·255. *Purchased.*

P. 3231. Anterior dorsal spine, about 0·425 in total length, exhibiting two alternating series of very large posterior denticles; with three imperfect cephalic spines. *Enniskillen Coll.*

38544. Anterior spine, 0·48 in total length, the denticles towards the extremity smaller and more numerous than usual. *Purchased*, 1864.

P. 5869. Crushed and broken spine, with larger denticles, exserted portion 0·34 in length. *Enniskillen Coll.*

39853. Much curved crushed and broken spine, the exserted portion measuring about 0·275 in length. *Purchased*, 1866.

P. 2165. Imperfect anterior spine. *Egerton Coll.*

P. 2166. Crushed spine, about 0·42 in total length. *Egerton Coll.*

P. 2802. Spine about 0·35 in total length, with several characteristic denticles. *Enniskillen Coll.*

P. 4279. Large crushed spine. *Enniskillen Coll.*

P. 3164. Large crushed spine, 0·435 in total length, with a few characteristic denticles. *Enniskillen Coll.*

20006. Posterior dorsal spine, about 0·23 in total length. *Johnson Coll.*

P. 5866. Imperfect posterior dorsal spine. *Egerton Coll.*

P. 5870. Less incomplete posterior dorsal spine, with characteristic denticles, the exserted portion measuring about 0·19 in length.

P. 2166 e. Corresponding spine, with very numerous closely arranged lateral ribs. *Egerton Coll.*

P. 4327. Imperfect much curved posterior spine. *Enniskillen Coll.*

P. 2166 c. Small spine, the exserted portion measuring 0·24, and the base 0·105; a few large denticles are closely arranged towards the extremity. *Egerton Coll.*

P. 2166 g. Imperfect spine, labelled by Agassiz *Hybodus homoprion*. *Egerton Coll.*

Hybodus medius, Agassiz.

1843. *Hybodus medius*, L. Agassiz, Poiss. Foss. vol. iii. p. 184, pl. xxiv. fig. 25.

Type. Group of teeth.

Teeth with a relatively low crown, the contour gradually rising into a median conical pointed eminence; lateral cones generally inconspicuous; superficial coronal wrinkles numerous and prominent. The lateral cones are relatively the largest in the most anterior teeth; and the most posterior teeth are not much elongated.

Form. & Loc. Lower Lias: Lyme Regis, Dorsetshire.

P. 340. Head and anterior portion of the trunk, preserved upon a slab of Lias, 1·17 m. (3 ft. 5 in.) in length, partly disturbed by the head of an *Ichthyosaurus*. The specimen is shown of one-fifth the natural size, in Pl. VII. fig. 2, and exhibits the crushed head and dentition from the lower aspect, the partly disturbed axial skeleton of the trunk in side-view, and the two dorsal fin-spines[1]. The outlines of the pterygo-quadrate (*ptq.*) and mandibular (*md.*) cartilages are distinguishable, exhibiting the usual form; and the adjoining extremities of the left hyomandibular (*hm.*) and ceratohyal (*ch.*) project beyond the left mandibular ramus. The dentition is somewhat scattered, and is closely similar to that shown in No. P. 2199, many of the teeth having more distinctly separated lateral cones than in No. 41103. Obscure traces of the branchial apparatus (*br.*) and the pectoral arch (*pct.*) occur behind the head; and still more posteriorly the neural arches and spines (*na.*) are arranged in broken, though comparatively regular series. The latter are broad and elongate, not clearly separated at their base, but without any indications of intercalary cartilages; and immediately below the series is a narrow vacant space, evidently implying the persistence of the notochord (*not.*). The abdominal region is well supported by strong ribs (*r.*), which are all unfortunately displaced, crushed, and broken. Towards the

[1] The second dorsal spine being detached is not shown in the figure.

hinder portion of the abdominal region, where the axial skeleton abruptly terminates in the fossil, a series of about nine broad elongated cartilages (*na*?) occurs higher upon the slab, with the appearance of having all the superior extremities fused together; and this may be interpreted, either as a displaced portion of the axial skeleton itself, or as the support of a dorsal fin. Both the dorsal fin-spines are much broken, the anterior (*dls'.*) being situated very far forwards, and the posterior being entirely detached from the slab. The back of the anterior spine is not quite flat, but raised into a slight median longitudinal keel, upon which are fixed two sparse series of large denticles.

Purchased, 1881.

41103. A large slab of Lias exhibiting the greater part of the left pterygo-quadrate (*pty.*) and mandibular (*md.*) cartilages, side view (Pl. IX. fig. 1), with the dentition, scattered shagreen, and three imperfect displaced "*Sphenonchi*." The outer teeth of each transverse series in both jaws are nearly all in position, and there thus appear to be eight series in each ramus, without a median symphysial row, as shown by the figure. There are also numerous other scattered teeth, exhibited from various aspects. In the lower jaw, the first tooth (I.) has much the highest and most prehensile crown, there being two large and perhaps one small lateral denticle. The second tooth (II.) is somewhat more elongated, with smaller lateral denticles; and in the teeth beyond, the denticles become very insignificant. The teeth of series IV. and V. are the largest, and the hindermost are much the smallest. In the upper jaw the most anterior teeth are much displaced, and there is a close general correspondence with the lower dentition, those teeth nearest the symphysis only differing from the opposing teeth in their relatively larger size.

Purchased, 1868.

P. 2199. Group of scattered large teeth, mostly of the typical form, but some with unusually prominent lateral cusps.

Egerton Coll.

36878-81, 38539-40. Twenty teeth, some with cleft summits, one of the latter shown, of the natural size, in Pl. IX. fig. 2.

Purchased, 1862, 1864.

P. 2200. About twenty-five teeth. *Egerton Coll.*

P. 2792, P. 2794. Seventeen teeth, two having the central eminence cleft, and two with the crown divided near one extremity (Pl. IX. fig. 3). *Enniskillen Coll.*

Hybodus reticulatus, Agassiz.

1822. Fossil jaw with a triple row of teeth, H. T. De la Beche, Trans. Geol. Soc. [2] vol. i. p. 44, pl. v. fig. 3.

1837–43. *Hybodus reticulatus,* L. Agassiz, Poiss. Foss. vol. iii. pp. 50, 180, pl. ix. figs. 1–9 [1], pl. xxiv. fig. 26, pl. xxii. *a.* figs. 22, 23.

(?) 1837. *Hybodus formosus,* L. Agassiz, *tom. cit.* p. 51, pl. ix. figs. 10, 11.

Type. Associated teeth, cartilage, and dorsal spines; Oxford Museum.

Teeth narrow, with a relatively high crown, the median eminence and all the lateral cones slender and sharply pointed; superficial coronal wrinkles fine and numerous, often not extending to the apex. In the anterior and principal teeth, the height of the median eminence is often equal to two-thirds or even three-quarters of the long diameter of the tooth: and this cone is almost invariably much bent both backwards and laterally. The root is of very loose texture.

Form. & Loc. Lower Lias: Lyme Regis, Dorsetshire.

P. 3163. Crushed head, showing the partially distorted outlines of one pterygo-quadrate cartilage and a number of scattered teeth. *Enniskillen Coll.*

40335. Portion of crushed head, showing shagreen and a few of the anterior teeth. Some of the teeth (Pl. X. figs. 16–18) are of a more prehensile character than any figured by Agassiz. *Purchased,* 1867.

P. 2198. Small specimen of associated cartilage, shagreen, and teeth. *Egerton Coll.*

P. 2198 a. Portions of the cartilages of the jaws, associated with a few teeth, and one "*Sphenonchus.*" *Egerton Coll.*

P. 2198 b. Two groups of teeth. *Egerton Coll.*

P. 2203 a. Fragmentary teeth associated with two "*Sphenonchi.*" *Egerton Coll.*

P. 2203 b. Three broken teeth, associated with fragments of shagreen and two "*Sphenonchi.*" *Egerton Coll.*

[1] Some of these spines may pertain to *Acrodus.*

P. 2208. Portions of left pterygo-quadrate, mandibular, hyomandibular, and ceratohyal cartilages, with a few imperfect teeth, and fragments of three "*Sphenonchi*" and one dorsal spine. *Egerton Coll.*

P. 3162. A few scattered teeth, associated with fragments of cartilage and shagreen. *Enniskillen Coll.*

P. 5876. Fragments of skull, jaws, and branchial arches, associated with teeth and the two dorsal fin-spines. Some caudal vertebræ of a small *Ichthyosaurus* are mingled with the remains. *Enniskillen Coll.*

P. 3156. Remains of a crushed head, with traces of teeth, two "*Sphenonchi*," and the first dorsal spine. *Enniskillen Coll.*

P. 423. Remains of the head, about five teeth, the first dorsal fin-spine, and shagreen.
Presented by F. Seymour Haden, Esq., 1882.

The dorsal fin-spines of this species are not readily distinguishable from those of *Acrodus anningiæ*. The anterior dorsal is long and slender, with the lateral ribs more or less acute and evenly spaced, and the denticles of moderate size, placed upon a longitudinal elevation of the posterior face. The following specimens are provisionally placed here :—

P. 3170. Anterior and posterior dorsal fin-spines, associated with fragments of cartilage. The superficial ganoine layer of the spines is almost destroyed. *Enniskillen Coll.*

P. 5865. Associated anterior and posterior spines, the exserted portion of the first measuring 0·22 in length, that of the second 0·185. *History unknown.*

42297. Much abraded and broken spine. *Purchased*, 1870.

P. 2166 h. Broken anterior spine, labelled by Agassiz *Hybodus incurvus*. *Egerton Coll.*

P. 2162. Slender spine, with comparatively flat posterior face, the exserted portion measuring 0·37. *Egerton Coll.*

P. 2826. Anterior spine, wanting posterior denticles and most of the inserted portion : the exserted portion measures 0·295, and the lateral ridges are not crowded behind in the proximal half. *Enniskillen Coll.*

P. 3165. Very long slender spine, wanting posterior denticles, 0·435 in total length. *Enniskillen Coll.*

37387. Small spine, exserted 0·14. *Purchased*, 1863.

46564. Small spine, 0·143 in total length. *Purchased*, 1875.

P. 2167. Small slender spine, exserted 0·105. *Egerton Coll.*

P. 2805. Small slender spine, exserted 0·17. *Enniskillen Coll.*

P. 2825, P. 2829. Two small spines, exserted 0·08 and 0·09 respectively. *Enniskillen Coll.*

P. 2817. Much abraded posterior spine, exserted 0·2. *Enniskillen Coll.*

An undetermined species allied to *Hybodus reticulatus* is indicated by a large slab from the Lias of Boll, Würtemberg (**P. 5880**), exhibiting remains of the cartilages of the mandibular, hyoid, and branchial arches, with a few imperfect teeth and one dorsal fin-spine.

Hybodus polyprion, Agassiz.

1843. *Hybodus polyprion*, L. Agassiz, Poiss. Foss. vol. iii. p. 185, pl. xxiii. figs. 1–15[1].

1871. *Hybodus polyprion*, J. Phillips, Geol. Oxford, p. 177, diagr. xxxvii. figs. 2, 3.

1871. *Hybodus jugosus*, J. Phillips, *op. cit.* p. 177, diagr. xxxvii. fig. 1.

1886. *Hybodus polyprion*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 257, pl. vi. figs. 1, 2.

Type. Detached teeth; School of Mines, Paris.

Teeth with a high much compressed crown; median cone oblique, except in the most anterior teeth; lateral cones two or three in number, broad. Coronal surface of the anterior and principal teeth smooth, except near the base, where marked by short vertical wrinkles; a few of the superficial wrinkles in the posterior teeth extending to the apices of the cones. Root short, depressed.

As already remarked by Agassiz and the present writer, some of the teeth of this species exhibit considerable resemblance to those of *Notidanus*.

Form. & Loc. Bathonian (Stonesfield Slate): Oxfordshire and (?) Somersetshire[2].

[1] It is not unlikely that some of these are small teeth of *H. grossiconus*.

[2] Quenstedt (Der Jura, 1858, p. 348, pl. 47. figs. 29, 30) refers some teeth to this species from the Continental "Brauner Jura β"; the determination is, however, very doubtful. The same may be said of the tooth from the Corallian

11123, 11124. Three typical teeth, one shown, of the natural size, in Pl. XI. fig. 2; Stonesfield. *Mantell Coll.*

28497. Two similar teeth; Stonesfield. *Dixon Coll.*

35494. Tooth with relatively small anterior denticles, described and figured by the present writer, *loc. cit.* p. 257, pl. vi. fig. 1; Stonesfield. *Purchased*, 1860.

38026, 39778. Two teeth; Stonesfield. *Purchased*, 1862–63.

39203. Four typical teeth, one of the hindermost shown, of the natural size, in Pl. XI. fig. 1; Stonesfield. *Bowerbank Coll.*

47974. Two similar teeth; Stonesfield. *Presented by the Hon. Robert Marsham*, 1877.

P. 2182. Four teeth; Stonesfield. *Egerton Coll.*

P. 2186, P. 2186 a. Two teeth, one with relatively small anterior denticles and serrations, described and figured by the present writer, *loc. cit.* p. 257, pl. vi. fig. 2; probably from the Great Oolite of Bath. *Egerton Coll.*

P. 2845. Two teeth, one figured, of the natural size, in Pl. XI. fig. 3; Stonesfield. *Enniskillen Coll.*

P. 5103. Typical tooth; Stonesfield. *Presented by J. E. Lee, Esq.*, 1885.

11139. Two teeth of the form named *H. jugosus* by Phillips; Stonesfield. So far as can be determined from these and the following specimens, it seems most probable that they are the posterior teeth of *H. polyprion*. *Mantell Coll.*

28590. Two similar teeth, one approaching the more typical *H. polyprion*; Eyeford. *Purchased*, 1853.

P. 2182 a, P. 2845 b. Two similar teeth; Stonesfield. *Egerton & Enniskillen Colls.*

P. 2182 b, P. 2845 a. Two anterior teeth, either of this species or *H. levis*; Stonesfield. *Egerton & Enniskillen Colls.*

Hybodus levis, sp. nov.

Type. Detached tooth (Pl. XI. fig. 5); British Museum.

The provisional name of *H. levis* may be given to the teeth from

of Hanover, noticed by Münster, Beitr. Petrefakt. vii (1846), p. 47. The North German Wealden and Purbeck teeth figured by Dunker and Meyer (Nordd. Wealdenbild. 1846, p. 68, pl. xv. fig. 22) and Struckmann (Wealdenbild. Umgegend Hannover, 1880, p. 58, pl. iii. fig. 9) do not pertain to this species.

Stonesfield mentioned below. In size they are as small as the teeth of *H. polyprion*, but seem to be specifically distinguished by the following characters:—Crown of principal teeth high, compressed, with a large erect median cone and two or three lateral cones, narrow and acutely pointed; coronal surface of all the teeth smooth, except quite at the base, where vertically wrinkled. Root depressed, flattened, expanded posteriorly.

Form. & Loc. Bathonian (Stonesfield Slate): Oxfordshire.

33474. Type specimen, shown, of twice the natural size, in Pl. XI. fig. 5; Stonesfield. *Purchased*, 1858.

39203 a. Less perfect tooth; Stonesfield. *Bowerbank Coll.*

P. 2182 d. Tooth, posterior aspect, shown, of twice the natural size, in Pl. XI. fig. 6; Stonesfield. The root has a considerable rounded posterior extension. *Egerton Coll.*

P. 2845 c. Low-crowned posterior tooth, shown, of twice the natural size, in Pl. XI. fig. 7; Stonesfield. The lateral cones are relatively broader and apparently more rounded than in the principal teeth. *Enniskillen Coll.*

P. 2845 d. Imperfect tooth: Stonesfield. *Enniskillen Coll.*

Hybodus grossiconus, Agassiz.

1843. *Hybodus grossicomus*, L. Agassiz, Poiss. Foss. vol. iii. p. 184, pl. xxiii. figs. 26–41 (? fig. 25).

1858. *Hybodus grossiconus*, F. A. Quenstedt, Der Jura, p. 348, pl. 47. fig. 33.

(?) 1858. *Hybodus monoprion*, F. A. Quenstedt, *op. cit.* p. 348, pl. 47. figs. 31, 32.

1871. *Hybodus grossiconus*, J. Phillips, Geol. Oxford, p. 177, diagr. xxxvii. figs. 4–6.

(?) 1875. *Hybodus polyprion*, K. Fricke, Palæontogr. vol. xxii. p. 393, pl. xxi. figs. 17, 18.

Type. Detached teeth; School of Mines, Paris; British Museum; and Caen Museum.

Teeth with a very high, much compressed crown; median cone very broad and nearly erect in the large principal teeth, narrower in the smaller teeth; lateral cones two or three in number, narrow and sharply pointed. Coronal surface marked by numerous delicate vertical wrinkles, extending to the apices in the lateral cones, but only reaching the apex of the median cone in the hinder small teeth. Root antero-posteriorly compressed.

Form. & Loc. Bathonian: Oxfordshire (Stonesfield Slate), Somersetshire, Gloucestershire, Wiltshire, and Normandy.

(i.) *Stonesfield Slate and Great Oolite.*

P. 2840. Tooth figured by Agassiz, *tom. cit.* pl. xxiii. fig. 40; Stonesfield, Oxfordshire. *Enniskillen Coll.*

P. 2841. Two similar specimens, marked as types by the Earl of Enniskillen, but not agreeing with any of Agassiz's figures; Stonesfield. *Enniskillen Coll.*

P. 2842. Slightly smaller tooth; Stonesfield. *Enniskillen Coll.*

P. 2183–4. Six large teeth, more or less imperfect, the first bearing Agassiz's MS. label; Stonesfield. *Egerton Coll.*

P. 5105. Imperfect large tooth; Stonesfield.
Presented by J. E. Lee, Esq., 1885.

47972. Three large teeth; Stonesfield.
Presented by the Hon. Robert Marsham, 1877.

11049, 11121, 11150. Two large and two small teeth; Stonesfield.
Mantell Coll.

39202. Two imperfect large teeth; Stonesfield. *Bowerbank Coll.*

28589. Ten teeth, some large, some small; Eyeford, near Stonesfield. *Purchased*, 1853.

28497 a, 32741, 35495, 36314, 37750. Seven teeth, mostly small.
Purchased.

48041. Three small teeth; Stonesfield.
John Brown Coll. Presented by Sir Richard Owen, 1859.

47973. One large and two small teeth; Stonesfield.
Presented by the Hon. Robert Marsham, 1877.

P. 2181. One small tooth labelled by Agassiz *H. polyprion*, and five others; Stonesfield. *Egerton Coll.*

P. 2845 e. Small tooth; Stonesfield. *Enniskillen Coll.*

P. 5104. Four small teeth; Stonesfield.
Presented by J. E. Lee, Esq., 1885.

28590 a. Four comparatively low-crowned hinder teeth, one shown, of the natural size, in Pl. XI. fig. 4; Stonesfield.
Purchased, 1853.

P. 2186 b. Large imperfect tooth; near Bath. *Egerton Coll.*

P. 5877. Ten imperfect teeth, mostly small; Minchinhampton, Gloucestershire. *Byne Coll.*

P. 4214. Two teeth; Lansdown, Bath. *Enniskillen Coll.*

32566. Three teeth; Caen, Normandy. *Tesson Coll.*

(ii.) *Forest Marble.*

24770. Tooth; Wiltshire. *Cunnington Coll.*

28442. Three small teeth; Stanton, Wiltshire. *Cunnington Coll.*

28441. Ten teeth, one showing the complete root; Wiltshire. *Cunnington Coll.*

32355. Tooth; Malmesbury, Wiltshire. *Purchased*, 1857.

30556. Two teeth; Atford, near Bath. *Purchased*, 1856.

46340. Five teeth; Atford. *Cunnington Coll.*

P. 2185. Two teeth; Atford. *Egerton Coll.*

Hybodus obtusus, Agassiz.

1843. *Hybodus obtusus*, L. Agassiz, Poiss. Foss. vol. iii. p. 186, pl. xxiii. figs. 43, 44.

1875. *Hybodus crassus*, K. Fricke (*non* Agassiz), Palæontogr. vol. xxii. p. 393, pl. xxi. fig. 19.

1887. *Hybodus obtusus*, H. M. Platnauer, Ann. Rep. Yorks. Phil. Soc. p. 35, pl. i. figs. 1–16.

Type. Detached teeth; Caen Museum.

Teeth with a high crown, moderately compressed. Median cone broad, sharply pointed in the anterior teeth, more obtuse in the posterior; lateral cones two or three in number, broad, high and pointed in the anterior teeth, considerably fused together in the posterior teeth. Coronal surface mostly smooth, with occasional faint wrinkles, and prominent excrescences at the base.

A fine series of fifteen detached teeth is figured by Platnauer from the Corallian of Malton, Yorkshire. The same author also makes known an imperfect dorsal fin-spine, probably of this species.

Form. & Loc. Bathonian: Caen, Normandy. Oxfordian: Huntingdonshire. Corallian: Yorkshire and Hanover. Lower Kimmeridgian: Oxfordshire and Dorsetshire.

39205. Six teeth; Coral Rag, Malton, Yorkshire. *Purchased*, 1865.

35670–73. Four teeth; Coral Rag, Malton. *Bean Coll.*

47968. Two teeth; Coral Rag, Wheatley.
Presented by the Hon. Robert Marsham, 1877.

41223. Ten teeth, one figured, of the natural size, anterior aspect, in Pl. XI. fig. 8; Kimmeridge Clay, near Weymouth.
Purchased, 1868.

41875. Seven large teeth, two figured, of the natural size, anterior aspect, in Pl. XI. figs. 9, 10; also four imperfect anterior teeth; near Weymouth. *Purchased*, 1869.

43569. Seven large teeth, one figured, of the natural size, posterior aspect, in Pl. XI. fig. 11; near Weymouth.
Purchased, 1872.

45927. Seven teeth, mostly smaller, and six fragments; near Weymouth. Two specimens are shown, of the natural size, in Pl. XI. figs. 12, 13. *Purchased*, 1874.

P. 2195. Five imperfect teeth; Kimmeridge Bay. *Egerton Coll.*

P. 5871. Three teeth; near Weymouth. *Enniskillen Coll.*

21430, 31367, 46352. Three teeth: Oxford Clay, Christian Malford, near Chippenham, Wiltshire. *Purchased.*

40463 a. Two derived teeth; Neocomian Bone-bed, Potton, Bedfordshire. *Purchased*, 1867.

46382 a. Three fragmentary derived teeth; Neocomian, Farringdon, Berkshire. *Cunnington Coll.*

Hybodus basanus, Egerton.

(?) 1837. *Hybodus sulcatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 44, pl. x. *b.* figs. 15, 16.
1845. *Hybodus basanus*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. i. p. 197, pl. iv.
1886. *Hybodus*, A. S. Woodward, Geol. Mag. [3] vol. iii. p. 258.

Type. Head, with dentition.

Teeth with a very high, much compressed crown; median cone narrow, slender, slightly arched inwards; lateral cones two, short but sharply pointed. Coronal surface marked by numerous very fine vertical wrinkles, often extending to the apices of the lateral cones, but always absent upon the smooth upper half of the median cone.

Form. & Loc. Upper Wealden: Isle of Wight and Sussex.

P. 2083. Plaster cast of type specimen ; Isle of Wight.
Egerton Coll.

P. 2082. Skull, mandibular, hyoid, and branchial arches, with remains of the dentition, referred to by the present writer, *loc. cit.* ; Pevensey Bay, Sussex. A side view of the specimen is given, of one half the natural size, in Pl. XII. fig. 1, indicating the general proportions of the pterygo-quadrate (*pty.*) and mandibular (*md.*) cartilages. The upper jaw projects forwards beyond the lower, and there is no evidence of an articulation of the pterygo-quadrate with the cranium, either in advance of or behind the orbit. The hyomandibular cartilage is only imperfectly shown, but seems to have been slender ; and there is distinct evidence of five pairs of branchial arches. Portions of the latter of the left side are shown, one half nat. size, in Pl. XII. fig. 3, *br.*$^{1-5}$; they rapidly diminish in size backwards, the fifth being very small and slender. The granular calcifications in all the cartilages appear to be entirely superficial. *Egerton Coll.*

P. 2082 a. A more imperfect head, with a portion of the dentition ; Pevensey Bay. The anterior extremities of the ceratohyal cartilages (*chy.*), with a large rounded basihyal (*bhy.*), are well shown (Pl. XII. fig. 2). *Egerton Coll.*

P. 3172. Head, scarcely crushed, with a nearly complete mandible, remains of the dentition, and indications of the large ceratohyal cartilages ; Pevensey Bay. *Enniskillen Coll.*

P. 3172 a. Portion of crushed head, with many imperfect teeth in at least three erect series, and also remains of the ceratohyals and branchial arches ; Pevensey Bay.
Enniskillen Coll.

P. 3172 b. A very imperfect large head ; Pevensey Bay.
Enniskillen Coll.

P. 3172 c. Smaller head, uncrushed, displaying part of the dentition, and showing the form and proportions of the occipital region of the cranium ; Pevensey Bay. *Enniskillen Coll.*

P. 3172 d. Portions of a small head, with the much broken anterior dorsal fin-spine ; Pevensey Bay. The massive character of the large ceratohyal cartilages is shown.
Enniskillen Coll.

P. 2082 b. Remains of a small head, showing part of the dentition and some of the branchial arches; Pevensey Bay.
Egerton Coll.

P. 2082 c. A very small head, with remains of the dentition, and indications of a very large massive ceratohyal cartilage; Pevensey Bay. *Egerton Coll.*

P. 2082 d. Associated imperfect teeth; Pevensey Bay.
Egerton Coll.

40717-8. Two very imperfect heads, one large, the other small; Bexhill. *Purchased*, 1867.

40716. Very imperfect head; Hollington. *Purchased*, 1867.

P. 2833. Portions of two associated dorsal fin-spines, probably of *H. basanus*, one shown, of the natural size, in Pl. XII. fig. 5; Hastings. *Enniskillen Coll.*

P. 2833 a. P. 2834. Proximal portions of two similar spines; Hastings and Tilgate Forest. *Enniskillen Coll.*

39254. Imperfect spine stouter and apparently distorted; Hastings. *Purchased*, 1865.

P. 5880. Two fragments of spines, probably of this species, from the Wealden, described as having been obtained from the Chalk of Lewes, and named *Hybodus sulcatus*, Agassiz, Poiss. Foss. vol. iii. p. 44, pl. x. *b*. figs. 15, 16.
Mantell Coll.

Hybodus sp. inc. (? **strictus,** Agassiz).

The following teeth were obtained from the Purbeck Beds of the neighbourhood of Swanage, Dorsetshire, and may pertain, at least in part, to *H. strictus*, Agassiz[1], hitherto only known by dorsal fin-spines.

21349. High-crowned tooth, very suggestive of *H. grossiconus*, with a single lateral cone on each side; coronal surface smooth, merely wrinkled near the base. Also a fragmentary smaller tooth, with narrower principal cone. *Purchased*, 1847.

P. 5296. Incomplete abraded tooth, probably similar.

21349 a. Fragment of a very large tooth, showing the long first lateral cones. *Purchased*, 1847.

[1] Poiss. Foss. vol. iii. (1837), p. 45, pl. x. figs. 7-9.

Hybodus sp. inc. (? **striatulus,** Agassiz).

Teeth with a very high, much compressed crown; median cone moderately broad; lateral cones one, two, or three in number, the inner pair very long, slender, and pointed. Coronal surface marked with numerous delicate vertical wrinkles, rarely extending more than half the height of the median cone, but often reaching the apices of the lateral cones.

These teeth are most probably referable to the species indicated by the dorsal fin-spines named *Hybodus striatulus*, Agassiz[1]; but there is yet no evidence of association, and other spines occur in the same beds. A very similar tooth from the Wealden of Hanover is named *H. polyprion* by C. Struckmann, Wealden-Bild. Umgegend Hannover (1880), p. 58, pl. iii. fig. 9.

Form. & Loc. Wealden: Tilgate Forest, Sussex.

2685, 2693, 2692, 2697, 3027, 3029, 3032, 3136, 3139 41, 3144, 3147–8. Sixteen teeth, some very fragmentary, one shown of the natural size in Pl. XI. fig. 15. *Mantell Coll.*

26024, 26026, 26038. Three teeth and two fragments, one shown of the natural size in Pl. XI. fig. 14. *Dixon Coll.*

P. 1276, P. 5823. The abraded principal cones of two similar teeth, figured among the type specimens of *Meristodon paradoxus* by L. Agassiz, *tom. cit.* pl. xxxvi. figs. 53, 54. *Egerton & Enniskillen Colls.*

28410, 28420. Nine more or less perfect teeth. *Mantell Coll.*

48377. Median cone of a very large smooth tooth. *Purchased*, 1877.

P. 2844. Two teeth and two imperfect associated teeth. *Enniskillen Coll.*

Three fragments, possibly of similar teeth, have also been obtained from the Lower Greensand of Godalming, Surrey.

(**P. 5520.** *Caleb Evans Coll.*)

Hybodus sp. inc.

Teeth with a relatively low crown; lateral denticles broad, two or three in number; coronal surface marked by few widely spaced wrinkles, many extending to the apices.

Form. & Loc. Wealden: Sussex. Neocomian: Isle of Wight.

28420 a. Specimen figured of the natural size in Pl. XI. fig. 16; Tilgate Forest. *Mantell Coll.*

[1] L. Agassiz, *tom. cit.* p. 44, pl. viii. *b.* fig. 1.

26027. Tooth with imperfect crown, but complete root; Tilgate Forest. *Dixon Coll.*

P. 4919 a. Three imperfect smaller teeth, with higher median cone; Hastings. *Dawson Coll.*

P. 4680. An abraded tooth; Lower Greensand, Isle of Wight. *Presented by C. Westendarp, Esq.*, 1884.

The following specimens may indicate late Cretaceous species of *Hybodus*, but the determination in each case is uncertain:—

45311. Group of eight naturally associated teeth and fragments, in form and proportions much resembling the Rhætic teeth named *Hybodus cloacinus*; English Chalk. *Purchased*, 1872.

P. 5878. Median portion of a very robust large tooth, the principal cone measuring 0·016 in height, and 0·01 in breadth at the base, and the coronal surface almost smooth; Chalk, Knapton, Yorkshire. *Bean Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Hybodus augustus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 191, pl. xxiv. figs. 9, 15; (?) H. von Meyer, Palæontogr. vol. i. (1849), p. 227, pl. xxviii. fig. 45; H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien (1865), p. 119 (*non* Gervais, Zool. et Pal. Franç., Poiss. p. 12, pl. lxxvii. fig. 6).—Muschelkalk: E. France, (?) and Silesia.

Hybodus attenuatus, H. von Meyer and T. Plieninger, Beitr. Pal. Württembergs (1844), p. 110, pl. xii. figs. 33, 34, 72, 76. *H. bimarginatus*, Meyer & Plieninger, *op. cit.* p. 114, pl. xii. figs. 27, 53, 60, 84.—Rhætic; Stuttgart.

Hybodus cristatus, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. (1845), p. 2, pl. ii. fig. 20.—L. Plänerkalk; Bohemia.

Hybodus inflatus, L. Agassiz, *tom. cit.* p. 186, pl. xxiii. fig. 42.—Inferior Oolite; Caen, Normandy.

Hybodus keuperianus, T. C. Winkler, Archiv. Mus. Teyler, vol. v. (1880), p. 116, pl. vi. figs. 15, 16.—Keuper; Wurzburg.

Hybodus makrothi, H. B. Geinitz, Dyas (1861), p. 27, pl. iv. fig. 4.—Kupferschiefer; Gera, Saxony.

Hybodus non-striatus, T. C. Winkler, *tom. cit.* livr. 2, p. 121, pl. vi. figs. 17, 18.—Keuper; Wurzburg.

Hybodus orthocomus, Meyer & Plieninger, *op. cit.* pp. 111, 119, pl. xii. figs. 77, 85, 87, 89.—Rhætic; Stuttgart.

Hybodus pusillus, W. Dunker, Nordd. Wealdenbild. (1846), p. 68, pl. xv. fig. 23.—Wealden; N. Germany.

Hybodus radix, C. G. Giebel, Fauna d. Vorw., Fische (1847), p. 317.—Lias: Quedlinburg, Prussia.

Hybodus stschurowskii: *Cladodus stschurowskii*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1880, pt. i. p. 1, pl. i. figs. 1–11. *Sphenodus macer*, H. Trautschold, Ergänz. Fauna Russ. Jura (1876), pl. iii. fig. 9.—Jurassic; Govt. of Moscow, Russia. [H. Trautschold (Bull. Soc. Imp. Nat. Moscou, 1880, pt. i. p. 196) assigns Kiprijanoff's fig. 1 to *Sphenodus longidens*, Ag., and figs. 2, 3, 5–9, to *S. macer*, Quenst. Fig. 4 evidently represents a tooth of *Oxyrhina*, but the others more resemble *Hybodus*.]

Hybodus sublævis, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 194, pl. xxii. *a*. figs. 3, 4 (*non* fig. 2); Meyer & Plieninger, Beitr. Pal. Württembergs (1844), p. 113, pl. xii. figs. 73, 74, 86; F. A. Quenstedt, Handb. Petrefakt. (1852), p. 176, pl. xiii. fig. 21.—Rhætic; Würtemberg.

Hybodus undulatus, L. Agassiz, *tom. cit.* p. 188, pl. xxii. *a*. fig. 11. —Rhætic; Linksfield, Elgin.

A tooth of *Hybodus*, from the Jurassic of Berne, Switzerland, is also figured by Thurmann & Etallon, Nouv. Mém. Soc. Helv. Sci. Nat. vol. xviii. (1864), pl. lxi. fig. 11; another (under the name of *Notidanus* sp.) from the Oxfordian of Switzerland, by E. Favre, Foss. Terr. Oxford. Alpes Tribourg. (Mém. Soc. Pal. Suisse, vol. iii. 1876), pl. ii. fig. 1: and a doubtful tooth (under the name of *Hybodus personati*), from the Braun Jura of Würtemberg, by F. A. Quenstedt, Jura (1858), p. 339, pl. xlvi. fig. 14.

As already remarked (p. 276) imperfect teeth precisely resembling those of *Hybodus* are also described under the name of *Meristodon*, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 286, the type species being *Oxyrhina* (*Meristodon*) *paradoxa*, Agassiz (*loc. cit.*). Other teeth of a similar type, from the Jurassic of Manganischlak, Caspian Sea, are named *Oxyrhina carinata* by E. von Eichwald, Geogn.-palæont. Bemerk. Halbinsel Manganischlak (1871), p. 14, pl. i. figs. 1-3; and "*Oxyrhina* (*Meristodon*) sp." is recorded by F. Stoliczka, Cretaceous Fauna S. India (Pal. Indica), vol. iv. (1873), pt. 4, p. 68, pl. xii. fig. 34. A distinct species, *Meristodon jurensis*, Sauvage, has also been determined by H. E. Sauvage from the Bajocian Beds of Montmorot, Jura Mts. (Bull. Soc. Géol. France, [3] vol. xi. (1883), p. 480, pl. xii. figs. 13, 14).

An indeterminable fragment of a tooth of a somewhat similar character, from the "Braun Jura *a*" of Würtemberg, is named *Selachidæ toralosi*, F. A. Quenstedt, Handb. Petrefakt. 1852, p. 173, pl. xiii. fig. 10.

Genus **ACRODUS**, Agassiz.

[Poiss. Foss. vol. iii. 1838, p. 139.]

Syn. *Sphenonchus*, L. Agassiz, *tom. cit.* 1843, p. 201 (in part).
Thectodus, Meyer & Plieninger, Beitr. Pal. Württembergs, 1844, p. 116.

A genus only differing from *Hybodus* in the rounded, non-cuspidate character of the teeth.

As in the case of *Hybodus*, the species are arranged in stratigraphical order; and all determinations of dorsal fin-spines must be regarded as provisional.

Acrodus gaillardoti, Agassiz.

1837. *Acrodus gaillardoti*, H. B. Geinitz (*ex* Agassiz, MS.), Beitr. Kennt. Thüring. Muschelkgeb. p. 21, pl. iii. fig. 5.
1839. *Acrodus gaillardoti*, L. Agassiz, Poiss. Foss. vol. iii. p. 146, pl. xxii. figs. 16–20.
1839. *Acrodus braunii*, L. Agassiz, *tom. cit.* p. 147, pl. xxii. fig. 26.
1849. *Acrodus gaillardoti*, H. von Meyer, Palæontogr. vol. i. p. 229, pl. xxviii figs. 3–8, 12, 13.
1849. *Acrodus braunii*, H. von Meyer, *loc. cit.* p. 231, pl. xxviii. figs. 1, 2.
1852. *Acrodus gaillardoti*, P. Gervais, Zool. et Pal. Franç., Explic. Pl. Poissons Foss. p. 13, pl. lxxvii. fig. 14.
1856. *Acrodus gaillardoti*, C. Giebel, Zeitschr. gesammt. Naturw. vol. viii. p. 428.
1857. *Acrodus gaillardoti*, C. Chop, Zeitschr. gesammt. Naturw. vol. ix. p. 130.
(?) 1859. *Acrodus gaillardoti*, K. von Schauroth, Sitzungsb. k. Akad. Wiss. math.-naturw. Cl. vol. xxxiv. p. 350, pl. iii. fig. 21.
1861. *Acrodus gaillardoti*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 16, pl. ii. figs. 29–32.
1865. *Acrodus gaillardoti*, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, p. 116.
1870. *Acrodus gaillardoti*, F. Roemer, Geol. von Oberschlesien, pl. xii. fig. 10.
1880. *Acrodus gaillardoti*, T. C. Winkler, Archiv. Mus. Teyler, vol. v. livr. 2, p. 109, pl. v. figs. 1–3.
1883. *Acrodus gaillardoti*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. xi. p. 494, pl. xii. fig. 4.

Type. Detached teeth.

A species of moderate size, the principal teeth not measuring more than 0·035 in length, gently rounded, marked by numerous fine branching and bifurcating wrinkles. Anterior teeth slightly keeled, not much elevated.

Form. & Loc. Bunter: Brunswick. Muschelkalk: Bavaria, Würtemberg, Hessen, Saxe-Weimar, Upper Silesia, Lorraine, and E. France. Keuper: Thuringia (*Giebel, Chop*).

P. 2131 a, P. 2755. Four typical teeth; Bunter Sandstone, Brunswick. *Egerton & Enniskillen Colls.*

P. 2760. Type specimen of *Acrodus braunii*, Agassiz; Bunter Sandstone, Zweibrücken, Brunswick. *Enniskillen Coll.*

1117–8. Two imperfect broad teeth, one much worn; Muschelkalk, Bayreuth, Bavaria. *Braun Coll.*

19683. Large tooth, measuring 0·032 in length, and a small narrow tooth, slightly keeled; Bayreuth. *Purchased*, 1845.

P. 2131. Small (? anterior) tooth and three larger; Bayreuth. *Egerton Coll.*

P. 2756. Narrow longitudinally keeled tooth, with prominent median rounded elevation; Bayreuth. *Enniskillen Coll.*

P. 2757. Small keeled tooth, probably of most anterior series; Muschelkalk, Mattstadt, near Jena. *Enniskillen Coll.*

28474. Seventeen small teeth, many longitudinally keeled, probably of this species; Hauptmuschelkalk Bone-bed, Crailsheim, Würtemberg. *Purchased*, 1853.

P. 298. Two small teeth; Muschelkalk, Meissner, Hessen. *Transferred from Mus. Practical Geology*, 1880.

32556. Narrow tooth; Muschelkalk, Lunéville. *Tesson Coll.*

Acrodus lateralis, Agassiz.

1839. *Acrodus lateralis*, L. Agassiz, Poiss. Foss. vol. iii. p. 147, pl. xxii. figs. 21, 22.
1843. *Hybodus obliquus*, L. Agassiz, *tom. cit.* pl. xxiv. figs. 1, 2.
(?) 1849. *Acrodus acutus*, H. von Meyer, Palæontogr. vol. i. p. 231, pl. xxviii. figs. 9, 10.
1852. *Acrodus*, P. Gervais, Zool. et Pal. Franç., Explic. Pl. Poiss. Foss. p. 13, pl. lxxvii. fig. 9.
1856. *Hybodus obliquus*, C. Giebel, Zeitschr. gesammt. Naturw. vol. viii. p. 427, pl. i. fig. 8.
1856. *Hybodus thuringiæ*, C. Giebel, *tom. cit.* p. 427, pl. i. fig. 9.
1857. *Hybodus thuringiæ*, C. Chop, Zeitschr. gesammt. Naturw. vol. ix. p. 129, pl. iv. fig. 3.
1857. *Acrodus brauni*, C. Chop, *tom. cit.* p. 130, pl. iv. fig. 4.
1861. *Acrodus lateralis*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 15, pl. ii. figs. 8–28.

1865. *Acrodus lateralis*, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, p. 60.

1883. *Acrodus lateralis*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. xi. p. 493.

Type. Detached teeth.

A small species, the principal teeth not measuring more than 0·01 in length, very similar to those of *A. gaillardoti*, but often more elevated and keeled (according to Schmid). Anterior teeth longitudinally keeled and much elevated at the broader extremity; superficial wrinkles dichotomously branching.

Form. & Loc. Muschelkalk: Lorraine, Saxe-Weimar, and Bavaria. Lettenkohl and Keuper: Saxe-Weimar (*Schmid*). Keuper: Thuringia.

P. 2132, P. 2151. Small comparatively low-crowned tooth, probably of this species; also one slightly larger, with the surface ornament in part reticulate, and obtained from Count Münster under the MS. name of *A. punctatus*, Münst.; Benk, Bavaria. *Egerton Coll.*

P. 2133, P. 2149. Seven typical teeth, five received from Count Münster under the MS. name of *A. pustulosus*, Münst.; Benk. *Egerton Coll.*

P. 2758, P. 2761. Five teeth; Benk. *Enniskillen Coll.*

P. 2133 a. Tooth in matrix; Laineck, Bavaria. *Egerton Coll.*

P. 2768. Broken tooth; Schlotheim, Gotha. *Enniskillen Coll.*

Acrodus keuperinus (Murchison & Strickland.)

1840. *Hybodus keuperinus*, Murchison & Strickland, Trans. Geol. Soc. [2] vol. v. p. 338, pl. xxviii. fig. 3.

1840. Teeth of *Hybodus*, Murchison & Strickland, *ibid.* fig. 3 *.

1861. *Lophodus*, W. S. Symonds, Old Bones, p. 103.

1863. *Nemacanthus*, S. J. Mackie, The Geologist, vol. vi. p. 243.

Type. Dorsal fin-spines and teeth.

Teeth of small size, mostly much elongated, compressed at right angles to the long axis. Coronal contour elevated mesially; longitudinal ridge prominent, dividing the surface into two unequal halves; superficial striæ strong, directly transverse.

Form. & Loc. Keuper: Worcestershire and Warwickshire.

P. 2152. Three teeth; Pendock, Worcestershire. *Egerton Coll.*

P. 2764. Six teeth, two shown, of twice the natural size, in Pl. XIII. figs. 1, 2; Pendock. *Enniskillen Coll.*

P. 5848. Three teeth ; Shrewley, Warwickshire.
Presented by the Rev. P. B. Brodie, 1888.

P. 2767. Nearly complete dorsal fin-spine destitute of posterior denticles, resembling that assigned to this species by Murchison and Strickland ; Rowington, Warwick.
Enniskillen Coll.

P. 4092. Extremely abraded fragmentary spine ; Rowington.
Presented by the Rev. P. B. Brodie, 1883.

46958. Three fragments ; Upper Keuper Conglomerate, Ripple, Worcestershire. *Purchased*, 1876.

P. 2766. Portion of base of spine, apparently less laterally compressed than No. P. 2767 ; Burgehill, Worcestershire.
Enniskillen Coll.

P. 2153, P. 2156. Five fragments ; Pendock. *Egerton Coll.*

P. 2765. Four fragments, two showing traces of posterior denticles ; Pendock. *Enniskillen Coll.*

46957. Imperfect large cephalic spine, associated with dorsal fin-spine ; Ripple. *Purchased*, 1876.

Acrodus minimus, Agassiz.

1839. *Acrodus minimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 145, pl. xxii. figs. 6–12.
1839. *Acrodus acutus*, L. Agassiz, *tom. cit.* p. 146, pl. xxii. figs. 13–15.
1844. *Acrodus minimus*, H. von Meyer & T. Plieninger, Beitr. Pal. Württembergs, p. 115, pl. x. figs. 25, 26, pl. xii. figs. 63, 82.
1844. *Thectodus inflatus*, Meyer & Plieninger, *op. cit.* p. 116, pl. x. fig. 20.
1844. *Thectodus glaber*, Meyer & Plieninger, *op. cit.* p. 116, pl. x. fig. 21.
1844. *Thectodus crenatus*, Meyer & Plieninger, *op. cit.* p. 116, pl. x. fig. 22, pl. xii. fig. 39.
1844. *Thectodus tricuspidatus*, Meyer & Plieninger, *op. cit.* p. 116, pl. x. fig. 27, pl. xii. fig. 29.
1852. *Acrodus minimus*, F. A. Quenstedt, Handb. Petrefakt. p. 179, pl. xiii. figs. 47–50.
1861. *Acrodus acutus*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 17, pl. ii. figs. 33–37.
1861. *Acrodus minimus*, E. E. Schmid, *loc. cit.* p. 17, pl. ii. fig. 38.
1865. *Acrodus minimus*, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, p. 118.
1871. *Acrodus minimus*, R. Etheridge, Proc. Cardiff Naturalists' Soc. vol. iii. pl. ii. figs. 15–17.

Type. Detached teeth; Bristol Museum.

A small species, the principal teeth not measuring more than 0·01 in length. Longitudinal keel moderately developed in all the teeth, a median transverse keel also in many: minute lateral denticles often present: superficial wrinkles large, occasionally feeble, sometimes bifurcated.

Form. & Loc. Keuper: Saxe-Weimar, Würtemberg, and Hanover. Rhætic: S.W. England, and (?) Elgin, Scotland.

23153. Two portions of bone-bed, with numerous teeth; Rhætic, Aust Cliff, near Bristol. *Purchased*, 1849.

P. 2155. About one hundred teeth from the Rhætic fissure at Holwell, near Frome, Somersetshire[1]. *Egerton Coll.*

P. 2135. Twenty teeth; Rhætic, Axmouth, Devonshire. *Egerton Coll.*

P. 2130. Slab with several teeth; Axmouth. *Egerton Coll.*

P. 2759. Twelve teeth; Axmouth. *Enniskillen Coll.*

P. 2136. Twelve teeth, supposed to have been obtained from the Rhætic of Linksfield, Elgin. *Egerton Coll.*

P. 2150. Two small teeth, probably of this species, received from Count Münster under the MS. name of *A. angustus*, Münst.; Hildesheim, Hanover. *Egerton Coll.*

Acrodus nobilis, Agassiz.

1837. *Acrodus nobilis*, W. Buckland, Geol. & Min. 2nd edit. vol. ii. p. 47, pl. 27 *e* (name and fig. only).
1838. *Acrodus nobilis*, L. Agassiz, Poiss. Foss. vol. iii. p. 140, pl. xxi.
1839. *Acrodus latus*, L. Agassiz, *tom. cit.* p. 144.
1839. *Acrodus gibbervulus*, L. Agassiz, *tom. cit.* p. 144, pl. xxii. figs. 1–3.
1840. *Acrodus nobilis*, R. Owen, Odontography, vol. i. p. 54, vol. ii. pls. xiv., xv.
1858. *Acrodus arietis*, F. A. Quenstedt, Jura, p. 90, pl. viii. fig. 10.

Type. Incomplete dentition; Bristol Museum.

The type species, of very large size, the principal teeth often measuring 0·045 in length. Coronal contour gently rounded, covered by very fine wrinkles, frequently branching and reticulate; longitudinal crest undeveloped, and only indicated by the divisional line of the ornament. Anterior teeth short and broad, without

[1] See Charles Moore, Quart. Journ. Geol. Soc. vol. xxiii. (1867), p. 483.

longitudinal keel, and with only faint indications of lateral denticles in one jaw; a median symphysial series present.

As shown by the series of specimens described below, there is considerable variation in the relative proportions of the successive rows of teeth, exactly as is to be observed in the dentition of the living *Cestracion*. It seems probable that the two principal series of teeth were always relatively smaller in one jaw than in the opposite: and this jaw is here provisionally regarded as the upper.

Though the originals of Agassiz's pl. xxi. figs. 4–7 are stated to be in the Enniskillen and Egerton Collections, they cannot now be identified.

Form. & Loc. Lower Lias: Dorsetshire, Würtemberg, Somersetshire, and (?) N. France.

Unless otherwise stated, all the specimens were obtained from the neighbourhood of Lyme Regis, Dorsetshire.

P. 3154. The crushed anterior portion of a fish of moderate size, exhibiting no definite outline, but merely fragments of cartilage associated with scattered teeth, shagreen, and the two dorsal fin-spines. The teeth exhibit the characteristic roundness and finely-marked coronal surface of those of *A. nobilis*, and those from the anterior portion of the jaw show traces of lateral prominences; the largest measure 0·022 in length. The shagreen-granules preserved are minute, slender and conical, longitudinally ribbed and grooved. The first dorsal spine is incomplete in the distal half and much broken, but the second dorsal is nearly perfect. The latter is comparatively short and stout, measuring 0·255 in total length; the lateral ribs are broad, rounded, and irregularly wavy; and the posterior face has the appearance of being slightly convex.

Enniskillen Coll.

P. 2736. A large portion of the dentition, figured, of the natural size, in Pl. XIII. fig. 3. The specimen shows about forty-four teeth arranged in natural order, and comprises the symphysial region, portions of the first three rows on one side, and portions of five on the other. Three small teeth (o) represent the median symphysial series, each measuring about 0·015 in length and exhibiting three lateral points. Of the first lateral series (1.), the teeth measure 0·018 in length, and are unsymmetrical, each having the greatest elevation near the anterior extremity, with three or four lateral points, widely separated behind, closely

approximated in front. Of series II., the teeth measure 0·025, and still show faint traces of lateral denticles, while considerably raised and broadened mesially. Of series III., the teeth nearly equal those of series IV.[1] in length, the former measuring 0·037 and the latter 0·04; they are also considerably raised mesially. Of series V., only two imperfect teeth are preserved, slightly shorter (0·035), less elevated, and narrower than those of series IV.

Enniskillen Coll.

P. 2142. Group of eighteen teeth, associated with fragments of cartilage and shagreen, and partly displaced; one aspect figured, of the natural size, in Pl. XIII. fig. 4. The teeth of series II. measure 0·018 in length; those of III. about 0·026; those of IV. and V., 0·035 and 0·038 respectively; and those of series VI. 0·032. Some of the teeth of series IV. and V. exhibit a constriction at each end of the much broadened central portion; and those of series VI. are notably narrow. *Egerton Coll.*

20573. Group of twenty teeth, nearly perfect, in natural order; Weston, near Bath. Series II. to V. are represented, and, though slightly larger, the relative proportions of the successive rows are very similar to those of No. P. 2142.

Johnson Coll.

35054. Group of about sixty naturally associated teeth, of nearly similar proportions to those of No. P. 2736. The anterior teeth exhibit the slight indications of lateral denticles.

Purchased, 1860.

P. 2738. About seventy-five teeth embedded in hard matrix, partly scattered and partly in natural order, indicating a dentition of very similar proportions to the preceding, but remarkable for the breadth of all the teeth.

Enniskillen Coll.

P. 2140, P. 2743. Group of comparatively broad teeth, much broken.

Egerton & Enniskillen Colls.

P. 2737, P. 2739. Two specimens, figured, of the natural size, in Pl. XIV. figs. 1, 2, displaying the complete dentition of one ramus of the jaw. They may possibly pertain to the same jaw, though they cannot have been found naturally apposed, as shown by the form of the matrix. Eight

[1] The tooth marked *a* in the figure is evidently misplaced.

series are indicated, seven as in the type specimen, and one additional hinder row. The proportions, however, are slightly different, as shown by the following measurements:—

Series.	No. of teeth preserved.	Length of tooth.
I.	7	0·017
II.	8	0·022
III.	8	0·028
IV.	8	0·046
V.	8	0·049
VI.	8	0·031
VII.	7	0·014
VIII.	2	0·008

In the first three series the teeth are relatively very broad, with rapidly tapering extremities; those of series IV. are blunt at each end, but narrowest anteriorly, and slightly bent at a faintly marked constriction near this extremity; the teeth of series V. are narrowest and least blunt posteriorly; the front half of each tooth of series VI. is much broader than the hinder half, gradually tapering posteriorly; the teeth of series VII. are nearly the same in breadth throughout, somewhat tapering at each extremity; and those of series VIII. are almost triangular, with the outwardly directed apex rounded, and the longitudinal divisional line of the surface-ornament arched. Of series I., three teeth show signs of wear; of II., three; of III., three; of IV., three; of V., four; and of VI., VII., and VIII., none but two exhibit distinct traces. *Enniskillen Coll.*

P. 2740. A group of naturally-arranged teeth of series V., VI., VII., partly figured, of the natural size, in Pl. XIV. fig. 3. The teeth of series VI., VII. are much longer in proportion to those of series V. than in No. P. 2739, the former measuring respectively 0·037 and 0·018, while the latter measure only 0·045. *Enniskillen Coll.*

P. 2741. Eight teeth of series VI., naturally arranged, with indications of series V. and VII., and two of the hindermost triangular teeth. *Enniskillen Coll.*

P. 2742. Forty-eight scattered, but naturally associated teeth, mostly very similar to those of Nos. P. 2737, P. 2739, but somewhat larger. *Enniskillen Coll.*

P. 3173. A smaller group of more imperfect scattered teeth in matrix. *Enniskillen Coll.*

P. 418. Numerous scattered teeth, naturally associated in matrix. *Presented by F. Seymour Haden, Esq.*, 1882.

P. 2144. Group of about ten imperfect teeth. *Egerton Coll.*

P. 5872. Six naturally-associated broad teeth; Weston, near Bath.

11258. Four detached teeth; Weston. *Mantell Coll.*

P. 2141. Six detached teeth; Weston. *Egerton Coll.*

P. 2744, P. 2746–7. Five detached teeth; Weston. *Enniskillen Coll.*

P. 2748. Three associated teeth; Keynsham, near Bath. *Enniskillen Coll.*

11279, 20161, 25850, 32753, 35727, 41280, 43393. Twelve detached teeth. *Purchased.*

P. 424. Five teeth. *Purchased*, 1882.

P. 2143. Two detached broad teeth, one showing a tendency towards a transverse division into two. *Egerton Coll.*

The dorsal fin-spines of *Acrodus nobilis* are large and curved; the lateral ribs are rounded and widely spaced; and the posterior denticles are of enormous size, placed upon a longitudinal elevation of the hinder face. The spines are associated with the teeth in No. P. 3154; and they occur in the Lias of Weston, near Bath, where the only known *Acrodus*-teeth are referable to this species. The following examples occur in the Collection:—

P. 3158. Naturally associated anterior and posterior dorsal spines, much crushed, and the latter incomplete proximally. The exserted portion of the first measures about 0·41 in length, and the base 0·14. *Enniskillen Coll.*

19814. Imperfect large spine. *Purchased*, 1845.

20008. Imperfect large stout spine. *Johnson Coll.*

30868. Imperfect pyritized large spine, the exserted portion measuring 0 25 in length. *Purchased*, 1856.

38126. Typical spine, the exserted portion measuring 0·4 in length, and the base 0·14. *Purchased*, 1864.

38543. Incomplete very large spine, abraded, with raised posterior face. *Purchased*, 1864.

37747. Imperfect large spine; locality unknown. *Purchased*, 1863.

P. 419. Very large typical spine, 0·515 in length.
Presented by F. Seymour Haden, Esq., 1882.

P. 2164. Gently curved anterior spine, showing denticles, exserted 0·355. *Egerton Coll.*

P. 2165 b. Large curved spine, somewhat broken. *Egerton Coll.*

P. 2166 d, P. 2168–9. Three imperfect large stout spines.
Egerton Coll.

P. 2301, P. 2820. Two large curved spines, the exserted portion of the first measuring 0·33 in length. *Enniskillen Coll.*

P. 2810, P. 2813 4, P. 2816. Four abraded large spines.
Enniskillen Coll.

P. 2811, 2812 a. Two large spines in matrix, somewhat crushed, one with very large posterior denticles and exserted 0·35, the other almost wanting denticles and exserted 0·38.
Enniskillen Coll.

P. 2812. Spine, wanting most of the posterior denticles, the exserted portion measuring 0·24 in length, and the base 0·1.
Enniskillen Coll.

20007 a. Nearly complete exserted portion of a stout spine, with very large denticles upon a posterior ridge, and the stout lateral ribs much interrupted proximally; Weston, near Bath. *Johnson Coll.*

P. 2819. Very similar spine, more complete, originally about 0·44 in total length. *Enniskillen Coll.*

P. 3157. Crushed and abraded curved spine. *Enniskillen Coll.*

P. 2165 a. Small spine, with posterior denticles, exserted 0·235.
Egerton Coll.

33288, 35726. Two imperfect large stout spines, perhaps posterior dorsal. *Purchased*, 1858, 1859.

20007. Posterior spine, wanting the greater portion of the base and posterior denticles, exserted 0·225, and the hinder face notably flattened; Weston. *Johnson Coll.*

P. 2165 c. Small spine, probably posterior, with large denticles upon a median ridge, exserted 0·145. *Egerton Coll.*

P. 2165. Similar spine, exserted 0·2. *Egerton Coll.*

P. 2818. Imperfect posterior spine. *Enniskillen Coll.*

P. 4175. Fragment of spine; Lias, Normandy. *Enniskillen Coll.*

Acrodus anningiæ, Agassiz.

1837. *Hybodus curtus*, L. Agassiz, Poiss. Foss. vol. iii. p. 49, pl. viii. *b.* figs. 4–6 (dorsal fin-spines).

1839. *Acrodus undulatus*=*Acrodus anningiæ*, L. Agassiz, *tom. cit.* p. 144, pl. xxii. fig. 4.

1864. *Acrodus anningiæ*, E. C. H. Day, Geol. Mag. vol. i. p. 57, pls. iii., iv.

Type. Series of teeth, artificially arranged; British Museum.

A species closely related to *A. nobilis*, but smaller, the principal teeth not measuring more than 0·03 in length. Coronal contour of the teeth less rounded than in *A. nobilis*, and the superficial wrinkles coarser. Anterior teeth moderately elongated, almost invariably with well-marked lateral prominences; a median symphysial series present.

It is still uncertain whether this "species" may not be founded —at least in part—upon the immature individuals of *A. nobilis*; but the Collection does not afford any very definite evidence of a passage between the two forms, and one specimen at least (No. 37371) seems to show that in *A. nobilis* the dorsal fin-spines were relatively smaller than in *A. anningiæ*. In this species, however, as in *A. nobilis*, the principal teeth of one jaw appear to be smaller than those of the other; and the former is proved to be the upper by specimen No. P. 2146.

Form. & Loc. Lower Lias: Dorsetshire.

All the following specimens were obtained from the neighbourhood of Lyme Regis.

P. 2731. Type specimen, consisting of forty teeth, probably found associated, but artificially and incorrectly arranged. *Enniskillen Coll.*

P. 3153. The crushed anterior portion of a small fish, exhibiting a few of the teeth, shagreen, and the first dorsal fin-spine. The shagreen consists of minute slender conical tubercles, longitudinally grooved, and sometimes fused into groups of two and three, as in *Hybodus*. The dorsal spine is much compressed laterally, and marked by sharp even ribs, widely spaced. *Enniskillen Coll.*

P. 2733. Twelve teeth associated with the anterior dorsal fin-spine of a still smaller fish. The spine exhibits very large denticles upon the slightly convex posterior face; and the lateral ridges are widely spaced, and rounded and nodose below. *Enniskillen Coll.*

P. 3152. Very fragmentary remains of the anterior portion of a larger fish. A few scattered teeth are shown, in association with three imperfect cephalic spines, and the crushed first dorsal fin-spine. The latter is much abraded and broken, but the superficial longitudinal ridges upon the proximal portion are evidently more rounded than in that of No. P. 3153, and faintly nodose; and the posterior denticles seem to be fixed in the lower part upon a median elevation of the hinder face. *Enniskillen Coll.*

38125. Remains of the head, with scattered teeth, portions of three cephalic spines, and shagreen, in association with the first dorsal fin-spine. The fin-spine is more perfect than in the last specimen, and exhibits no prominent elevation upon the posterior face; in other features it is similar. *Purchased*, 1864.

Fig. 9.

Associated teeth of *Acrodus anningiæ*, Agassiz.—Lower Lias, Lyme Regis (No. 37371). Nat. size.

37371. Twenty-three teeth associated with the two dorsal fin-spines. Five of the teeth and the spines are described and figured by E. C. H. Day, *loc. cit.*; the figures of the teeth being reproduced in the accompanying woodcut (fig. 9). *Purchased*, 1863.

P. 3155. Remains of a large head, exhibiting fragments of cartilage, shagreen, and several teeth. *Enniskillen Coll.*

P. 2146. An imperfect laterally compressed head, exhibiting teeth, shagreen, and the bases of three cephalic spines. The outlines of none of the cartilages can be discerned, but the left pterygo-quadrate is pressed slightly upwards, thus exposing the dentition of the right side, as shown, of the natural size, in Pl. XV. fig. 1. The lateral prominences of the anterior teeth are scarcely evident, and thus suggestive of *A. nobilis*; but the coarseness of the coronal markings and the form of the principal teeth point rather to *A. cuningtoni*, with which the specimen is here provisionally associated. The teeth of series II. to VI. are readily recognizable; and two teeth in front and one behind appear to be respectively referable to series I. and VII. The last-named tooth measures 0·011 in length, and is notably broad, with blunt extremities. In series II. and III. the teeth are elevated to an obtuse point, with the longitudinal division-line of the coronal ornament forming a slight crest; and they measure respectively about 0·015 and 0·02 in length. The teeth of the succeeding series are more flattened; those of no. IV. are broadest near the anterior extremity, measuring 0·023; those of no. V. (0·025 in length) are narrow in front and relatively broad in the posterior half, where each is almost divided into two by a transverse suture. In series VI. the teeth taper only slightly at each extremity, though most behind, and these attain a length of about 0·017. The shagreen is similar to that already described upon the head of *Hybodus delabecheï* (p. 260, Pl. VIII.), the largest tubercles being upon the frontal region, and the smallest behind; but the latter, so far as preserved, do not exhibit any fusion into groups of three. *Egerton Coll.*

P. 2735. Fragment of a head, exhibiting a cephalic spine and numerous teeth. The cephalic spine, of which the projecting portion is almost perfect, is very similar to that of *Hybodus*. The teeth are characteristic of the species, and those situated anteriorly have distinct lateral prominences. *Enniskillen Coll.*

P. 2145. Fragment apparently of the upper jaw showing minute comparatively blunt shagreen-granules and some of the principal teeth. The crown of one of the larger teeth is

slightly divided into two unsymmetrical eminences, one smaller than the other, with traces of lateral denticles.
Egerton Coll.

P. 2734. Right pterygo quadrate and mandibular cartilages, with about twenty teeth, much displaced. *Enniskillen Coll.*

39925. Plaster cast of the dentition probably of the lower jaw, described and figured by E. C. H. Day, *loc. cit.*, and shown in the accompanying woodcut (fig. 10); original in the collection of S. H. Beckles, Esq., of St. Leonards.
Purchased, 1866.

P. 2732. Portions of the dental series II. to VI. of one half of a similar, but larger jaw, shown of the natural size in Pl. XIV. fig. 4. The length of the teeth of the successive series is as follows:—II. 0·019, III. 0·024, IV. 0·028, V. 0·024, VI. 0·016. Slight indications of lateral prominences are observed in nearly all the teeth, and the coronal contour is much raised in series II. to IV. In series V. the teeth are very obtuse in front, but gradually taper behind: and those of no. VI. are comparatively narrow, tapering at each extremity. *Enniskillen Coll.*

32751. A group of teeth, also probably of the lower jaw, having less elevated crowns than in the last specimen.
Purchased, 1857.

P. 2137-8. Three small groups of typical teeth. *Egerton Coll.*

32752. Five detached teeth, the crown of one divided into two well-marked eminences, and three of the others approaching a similar form. *Purchased*, 1857.

P. 2139. A posterior series of four small teeth, and nine detached teeth. *Egerton Coll.*

P. 2745. Elongated principal tooth, the crown marked by two faint transverse constrictions. *Enniskillen Coll.*

As already remarked (p. 267) the dorsal fin-spines of *Acrodus anningiæ* can scarcely be distinguished from those of *Hybodus reticulatus*. They were first described by E. C. H. Day (*loc. cit.*), who pointed out that the second dorsal formed the type of Agassiz's *Hybodus curtus*. The first dorsal is long and slender, and seems to differ from that of *H. reticulatus* in the more rounded character of the ribs and the relatively wider spaces between those placed anteriorly. The posterior face bearing the denticles is not much

Fig. 10.

Dentition of *Acrodus anningiæ*, Agassiz.—Lower Lias, Lyme Regis (No. 39925). Nat. size.

raised, only slightly convex. Most of the following specimens may be assigned to this species.

(i.) *Anterior dorsal fin-spines.*

28282. Large crushed specimen in matrix. *Purchased*, 1853.

29012. Incomplete specimen. *Purchased*, 1854.

P. 2206. Imperfect pyritized spine. *Egerton Coll.*

P. 2166 a. Imperfect specimen, exserted about 0·24. *Egerton Coll.*

P. 2750. Much crushed spine, showing few denticles, exserted 0·4. *Enniskillen Coll.*

P. 2803 4. Two imperfect specimens. *Enniskillen Coll.*

P. 5007. Fine specimen, exserted about 0·26; the posterior face almost flat, and the denticles large and alternating. *Presented by J. E. Lee, Esq.*, 1885.

P. 5868. Spine with very large denticles, 0·37 in length.

P. 2822. Type specimen of *Hybodus carinatus*, Agassiz[1], probably referable to the young of *Acrodus anningiæ*. *Enniskillen Coll.*

P. 2815, P. 2824. Two similar spines. *Enniskillen Coll.*

P. 3167. Doubtful small spine, with widely spaced nodose ribs, associated with a portion of the posterior spine. *Enniskillen Coll.*

P. 2167. Small spine, with ornament very similar to that of No. P. 2733. *Egerton Coll.*

(ii.) *Posterior dorsal fin-spines.*

P. 491. Specimen figured by Agassiz, Poiss. Foss. vol. iii. pl. viii. *b.* fig. 4 (*Hybodus curtus*). *Egerton Coll.*

P. 2808. Specimen figured by Agassiz, *tom. cit.* pl. viii. *b.* fig. 5 (*Hybodus curtus*); Keynsham, near Bath. *Enniskillen Coll.*

P. 2807, P. 2809. Two imperfect examples, the second labelled "*Hybodus curtus*" by Agassiz. *Enniskillen Coll.*

P. 2821. Small spine, 0·2 in total length, perhaps correctly placed here. *Enniskillen Coll.*

[1] Poiss. Foss. vol. iii. (1837), p. 52, pl. ix. figs. 13, 14.

P. 5867. Small spine, 0·33 in total length, with traces of moderately-sized denticles, perhaps correctly placed here.

Acrodus leiodus, A. S. Woodward.

1844. *Acrodus leiodus*, L. Agassiz, Poiss. Foss. vol. i. p. xxxviii (name only).

1871. *Acrodus*, J. Phillips, Geol. Oxford, diagr. xxxvii. p. 177, fig. 10.

1887. *Acrodus leiodus*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 101, woodc.

Type. Detached teeth; British Museum.

Principal teeth not attaining to a greater length than 0·01. Coronal contour gently rounded, with an obtuse median longitudinal keel, and very little elevated even in the anterior teeth. Superficial ridges large and rounded, disposed in the usual manner; traces of lateral prominences in the anterior teeth indistinct.

Form. & Loc. Bathonian: Wiltshire, Oxfordshire, and Gloucestershire.

P. 5873. Type specimen, figured, of twice the natural size, in Pl. XIII. fig. 6; Great Oolite, Minchinhampton, Gloucestershire. *Byne Coll.*

P. 5874. Six teeth, five abraded and broken, the sixth from the symphysial region, and shown, of twice the natural size, in Pl. XIII. fig. 5; Great Oolite, Minchinhampton. *Byne Coll.*

36583, 41316. Three teeth; Stonesfield Slate, Stonesfield, Oxfordshire. *Purchased*, 1862, 1869.

P. 2134. Three abraded and broken teeth bearing Agassiz's MS. label; Stonesfield Slate, Stonesfield. *Egerton Coll.*

P. 2753. Four teeth, one shown, of thrice the natural size, in Pl. XIII. fig. 7; Stonesfield Slate, Stonesfield. *Enniskillen Coll.*

30559. Tooth; Forest Marble, Atford, near Bath. *Purchased*, 1856.

Acrodus leiopleurus, Agassiz.

1839. *Acrodus leiopleurus*, L. Agassiz, Poiss. Foss. vol. iii. p. 145, pl. xxii. fig. 5.

1887. *Acrodus leiopleurus*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 102.

Type. Detached tooth; Bristol Museum.

A small, imperfectly known species, characterized by the con-

siderable elevation of the dental crown, and the angularity of the numerous branching superficial coronal wrinkles: lateral prominences in the known teeth distinct and large.

Form. & Loc. Bathonian: Gloucestershire.

P. 5875. Perfect tooth, described by the present writer, *loc. cit.*, and figured, of twice the natural size, in Pl. XIII. figs. 8, 8 *a*; Great Oolite, Minchinhampton. *Byne Coll.*

Acrodus hirudo, Agassiz.

1839. *Acrodus hirudo*, L. Agassiz, Poiss. Foss. vol. iii. p. 148, pl. xxii. fig. 27.

1887. *Acrodus hirudo*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 102.

Type. Detached tooth; British Museum.

Principal teeth about 0·025 in length. Coronal contour gently rounded, the surface marked by extremely fine wrinkles diverging from a central faintly-marked longitudinal groove.

Form. & Loc. Wealden: Sussex.

2706. Type specimen, inverted in the figure given by Agassiz: Tilgate Forest. *Mantell Coll.*

P. 4994. A smaller more perfect tooth, described by the present writer, *loc. cit.*, and shown, of twice the natural size, in Pl. XIII. figs. 9, 9 *a*; Telham, near Battle.
Presented by J. E. Lee, Esq., 1885.

Acrodus ornatus, sp. nov.

Type. Detached tooth; British Museum.

An imperfectly known species, founded upon the small tooth, shown, of thrice the natural size, in Pl. XIII. fig. 10. The dental coronal contour is low and gently rounded, marked by a longitudinal median wrinkle: the laterally directed wrinkles are short, stout, and marginal, but few extending to the middle line.

Form. & Loc. Wealden; Isle of Wight.

P. 5275, P. 5275 a. Type specimen and a more elongated abraded tooth; Brixton. *Fox Coll.*

Acrodus levis, A. S. Woodward.

1887. *Acrodus levis*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 103, woodc. figs. 2, 3.

Type. Detached teeth; British Museum.

Principal teeth attaining a length of about 0·013. Coronal con-

tour rounded and much elevated, often notably smooth, being marked only by a few sharp wrinkles. Anterior teeth with distinct indications of lateral prominences.

Form. & Loc. Gault: Kent.

47293 a, P. 11 a, P. 11 b. Two type specimens, and a tooth with a smoother coronal surface, shown, of twice the natural size, in Pl. XIV. figs. 5–7; Folkestone. *Gardner Coll.*

47223, 47293-4, P. 11, P. 17. Six teeth: Folkestone. *Gardner Coll.*

Acrodus nitidus, A. S. Woodward.

1888. *Acrodus nitidus*, A. S. Woodward, Ann. Mag. Nat. Hist. [6] vol. ii. p. 135.

Type. Detached tooth; British Museum.

An imperfectly recognizable species, founded upon the unique tooth shown, of thrice the natural size, in Pl. XIV. fig. 8. The dental crown is low and rounded and remarkably smooth, the faint wrinkles being only exhibited near the margin, though perhaps partly destroyed by abrasion.

Form. & Loc. Upper Cretaceous: Bahia, Brazil.

P. 5536. Type specimen. *Presented by Joseph Mawson, Esq.*, 1888.

Acrodus (?) illingworthi, Dixon.

1850. *Acrodus illingworthi*, F. Dixon, Foss. Suss. p. 364, pl. xxx. figs. 11, 12, pl. xxxii. fig. 9.

1887. *Acrodus* (?) *illingworthi*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 104.

1888. *Acrodus* (?) *illingworthi*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 200.

Type. Imperfect detached teeth; British Museum.

A species of uncertain generic position founded upon teeth much like those of *Acrodus*, but more elongated, and some very suggestive of *Orodus*. Mesially, each tooth is considerably elevated, and there are faint indications of numerous lateral denticles; the coronal wrinkles are numerous, prominent, and sharp.

Form. & Loc. Chalk: Sussex, Surrey, and Kent.

25777–8. Two imperfect teeth, the type specimens figured by Dixon, *op. cit.* pl. xxx. figs. 11, 12; Southeram, Sussex. *Dixon Coll.*

49858. Typical tooth; L. Chalk, Guildford, Surrey. *Capron Coll.*

39059. Typical tooth; Dorking, Surrey. *Bowerbank Coll.*

37161. Elongated tooth; L. Chalk, Dover, Kent. *Purchased*, 1863.

P. 5879. Much elongated tooth; Southeram.
Presented by the Rev. E. A. Illingworth.

P. 2148. Similar tooth; Sussex. *Egerton Coll.*

P. 2752. Imperfect similar tooth; Southeram. *Enniskillen Coll.*

P. 5397. Fragments of three similar teeth, associated; Lewes.
Presented by P. E. Coombe, Esq., 1888.

P. 5398. A comparatively short much rounded tooth, pertaining either to this species or to *A. levis*; referred to the latter by the present writer in Proc. Geol. Assoc. vol. x. p. 290; Lewes. *Presented by P. E. Coombe, Esq.*, 1888.

The following specimens may pertain either to *Acrodus* or *Cestracion*:—

22492. Two small teeth with a longitudinal ridge-fold, and the lateral markings semi-reticulate, of the form named *Acrodus semirugosus*, T. Plieninger, Württ. Jahresh. vol. iii. (1847), p. 227, pl. ii. fig. 17; Corallian, Schnaitheim, Würtemberg. *Purchased*, 1848.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Acrodus affinis, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. (1845), p. 1, pl. ii. figs. 3, 4; A. Fritsch, Rept. u. Fische böhm. Kreideform. 1878, p. 15, fig. 37; H. B. Geinitz, Palæontogr. vol. xx. pt. ii. (1875), p. 212.—Plänerkalk; Bohemia and Saxony.

Acrodus augustus, C. G. Giebel, Fauna d. Vorw., Fische (1848), p. 327.—Lias; Quedlinburg.

Acrodus emmonsi, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1872, p. 163. "*Acrodus*, Emmons, N. Carolina Geol. Surv. 1858, p. 244, fig. 97.—Miocene; North Carolina" (?).

Acrodus flemingianus, L. G. de Koninck, Quart. Journ. Geol. Soc. vol. xix. (1863), p. 17, pl. viii. fig. 5.—Productus Limestone; Salt Range, Punjab, India.

Acrodus humilis, J. Leidy, Proc. Acad. Nat. Sci. Philad. 1872, p. 163; Ext. Vert. Fauna West. Territ. (U.S. Geol. Surv. Territ. vol. i. 1873), p. 301, pl. xxxvii. fig. 5.—Cretaceous; New Jersey.

Acrodus immarginatus, H. von Meyer, Palæontogr. vol. i. (1849), p. 232, pl. xxviii. fig. 11.—Upper Muschelkalk; Silesia. [*Orodus triadus*, Schmid (Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9, p. 11, pl. i. figs. 38–40), is also referred to this species by H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, 1865, p. 62.]

Acrodus microdus, T. C. Winkler, Archiv. Mus. Teyler, vol. v. livr. 2 (1880), p. 111, pl. v. figs. 4–11.—Trias; Wurzburg.

Acrodus persmati, F. A. Quenstedt, Jura (1858), p. 339, pl. xlvi. fig. 11.—Braun Jura β; Würtemberg.

Acrodus pulvinatus, H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien, 1865, p. 117: *Strophodus pulvinatus*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9 (1861), p. 13, pl. ii. figs. 2, 3.—Upper Muschelkalk; Jena. [To this species, also, H. Eck (*op. cit.*) adds *A. gaillardoti*, H. von Meyer, Palæontogr. vol. i. p. 229, pl. xxviii. figs. 3–5.]

(?) *Acrodus rugosus*: *Strophodus rugosus*, E. E. Schmid, *loc. cit.* p. 14, pl. ii. fig. 4.—Upper Muschelkalk; Jena. [This species is accepted and recorded from France by H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. xi. (1883), p. 493, pl. xii. fig. 1; but the name is regarded as a synonym of *A. gaillardoti* by H. Eck, *op. cit.* p. 116.]

Acrodus simplex: *Hybodus simplex*, H. von Meyer, Palæontogr. vol. i. (1849), p. 228, pl. xxviii. fig. 42.—Muschelkalk; Silesia.

Acrodus spitzbergensis, J. W. Hulke, Bihang k. Svenska Vet.-Akad. Handl. vol. i. (1873), no. 9, p. 10.—Saurie Hook, Spitzbergen.

Acrodus substriatus, H. Eck, *op. cit.* p. 62: *Strophodus substriatus*, E. E. Schmid, *loc. cit.* p. 12, pl. ii. figs. 6, 7.—Upper Muschelkalk; Jena.

(?) *Acrodus virgatus*: *Strophodus virgatus*, E. E. Schmid, *loc. cit.* p. 14, pl. ii. fig. 5.—Keuper; Jena.

Teeth of *Acrodus*, from the Rhætic or Lias of Linksfield, near Elgin, are also figured by P. Duff, 'Geology of Moray,' 1842, pl. iv. figs. 12, 13. A species closely related to *A. lateralis*, from Chenderoo, in the Punjab, India, is recorded by L. G. de Koninck, Quart. Journ. Geol. Soc. vol. xix. (1863), p. 16.

A doubtful tooth, from the Miocene of Turin, is also named *Acrodus gastaldi*, O. G. Costa, Ann. Accad. Aspir. Nat. Napoli, [3] vol. iii. (1864), p. 30, pl. v. fig. 1: another, from the Upper Eocene

of Bavaria, is named *Acrodus flexuosus*, K. E. Schafhäutl, Süd-Bayerns Leth. Geogn. (1863), p. 244, pl. lxiv. fig. 2.

The following ribbed dorsal spines and hook-like cephalic spines pertain to various species of *Hybodus* and *Acrodus*, but cannot yet be even approximately determined. They may be conveniently arranged in stratigraphical order:—

I. Muschelkalk. (a) *Dorsal Fin-spines.*

48205. Basal portion of a large spine, assignable to the so-called *Hybodus major*, Agassiz[1]; Lunéville. *Purchased*, 1877.

19685, 21509. Fragments of two smaller spines; Bayreuth, Bavaria. *Purchased*, 1845, 1847.

P. 2160, P. 2175. Imperfect small spine, and fragment of one still smaller: the latter labelled "*Hybodus dimidiatus*, Agass.,"[2] by Egerton, but not showing notches in the posterior denticles, and more resembling *H. tenuis*, Agassiz[3]; Bayreuth. *Egerton Coll.*

P. 2780. Small broken spine; Bayreuth. *Enniskillen Coll.*

II. Keuper.

P. 2178. Short dorsal fin-spine; Schlotheim, near Gotha. *Egerton Coll.*

III. Lias.—In addition to numerous fragments, the following indeterminable spines from the Lower Lias of Lyme Regis, Dorsetshire, may be enumerated:—

(a) *Dorsal Fin-spines.*

30869, 32748–9, 41381. Five small spines, approaching the spine named *H. crassispinus*. *Purchased*, 1856–57, 1869.

P. 152. Slender spine, the exserted portion measuring 0·1. *Purchased*, 1880.

P. 425. Two smaller spines. *Purchased*, 1882.

[1] L. Agassiz, Poiss. Foss. vol. iii. p. 52, pl. viii. *b*. figs. 7–12; (?) H. von Meyer, Palæontogr. vol. i. (1849), p. 222, pl. xxx. figs. 3–5; F. Roemer, Geol. von Oberschlesien (1870), pl. xii. fig. 21.

[2] L. Agassiz, *tom. cit.* p. 53, pl. viii. *b*. figs. 13, 14.

[3] L. Agassiz, *tom. cit.* p. 54, pl. viii. *b*. fig. 15. (?) H. von Meyer, Palæontogr. vol. i. (1849), p. 223, pl. xxx. fig. 6; H. v. Meyer & T. Plieninger, Beitr. Pal. Württembergs, p. 56, pl. xii. fig. 69. (?) C. Giebel, Zeitschr. gesammt. Naturw. vol. viii. (1856), p. 425, pl. i. fig. 5.

P. 2167. Eleven small spines, mostly with large posterior denticles, some approaching "*H. crassispinus*," some much larger. *Egerton Coll.*

P. 2828. Type specimen of *H. crassispinus* described by Agassiz, Poiss. Foss. vol. iii. (1837), p. 48, pl. viii. *b*. fig. 7. *Enniskillen Coll.*

P. 2815, P. 2823, P. 2829, P. 4427–9. Twenty small spines, some like "*H. crassispinus*," some more slender and more finely ribbed, others much larger. *Enniskillen Coll.*

(b) *Cephalic Spines.*

36164. Nearly complete spine with small protuberances at the base of the exserted portion, the so-called *Sphenonchus hamatus*, Agass.[1] *Purchased*, 1861.

41350. Three examples. *Purchased*, 1869.

38538. Exserted portion of a similar spine. *Purchased*, 1864.

P. 2204. Three more or less complete examples, one with broad rounded base, the others with the base more compressed: one is labelled in Agassiz's handwriting, "*Sphenonchus hamatus*, Ag." *Egerton Coll.*

P. 2772. Seven specimens, five nearly perfect, showing a single barb. *Enniskillen Coll.*

P. 4630. Two spines, associated with cartilage and shagreen. *Enniskillen Coll.*

IV. Lower Oolite. (a) *Dorsal Fin-spines.*

47144. Type specimen of *Hybodus crassus*, Agassiz, described and figured, *tom. cit.* p. 47, pl. x. fig. 23, said to have been obtained from the Inferior Oolite of Braunston, Oakham: the locality cannot be accurate, and is given by Agassiz as Rodmore Pits, near Towcester. *Sharp Coll.*

47439. A small finely-ribbed compressed spine, the exserted portion measuring about 0·09 in length, and its base-line very oblique; posterior denticles small, though mostly destroyed; Inferior Oolite, Stamford, Lincolnshire. *Sharp Coll.*

P. 2153. Extremity of a spine resembling that named *Hybodus apicalis*, Agassiz[2]: Stonesfield Slate, Stonesfield. *Egerton Coll.*

[1] L. Agassiz, Poiss. Foss. vol. iii. (1843) p. 202, pl. xxii. *a*. figs. 12–14.

[2] Poiss. Foss. vol. iii. (1837) p. 43, pl. x. fig. 22. This is not *H. apicalis*, Agass., *tom. cit.* p. 195, pl. xxiii. figs. 16–20.

P. 2831. Type specimen of *Hybodus dorsalis*, Agassiz, described and figured, *tom. cit.* p. 42, pl. x. fig. 1; Stonesfield Slate, Stonesfield. *Enniskillen Coll.*

P. 2159. The fragmentary extremities of two similar spines; Stonesfield. *Egerton Coll.*

47142. Portion of a nearly similar spine, more curved, with larger posterior denticles; Great Oolite, Blisworth, Northamptonshire. *Sharp Coll.*

P. 2904. Type specimen of *Hybodus marginalis*, Agassiz, described and figured, *tom. cit.* p. 43, pl. x. fig. 18; Stonesfield Slate, Stonesfield [1]. *Enniskillen Coll.*

P. 490. Smaller fragment assigned to *H. marginalis*, Agassiz, *tom. cit.* pl. x. figs. 19, 20; Stonesfield. *Egerton Coll.*

P. 2832. Portion of still smaller spine, labelled "*Hybodus marginalis*, Agass.," in Agassiz's handwriting; Stonesfield. *Enniskillen Coll.*

47146-7. Two imperfect abraded stout spines, larger than the foregoing; Great Oolite, Orton, near Peterborough. *Sharp Coll.*

P. 2161. Extremely abraded but less incomplete example of the same spine; Great Oolite, Stonesfield [2]. *Egerton Coll.*

47143. Worn extremity of an equally large and stout spine; Great Oolite, Weedon, Buckinghamshire. *Sharp Coll.*

V. Kimmeridge Clay. (a) *Dorsal Fin-spines.*

P. 489. Type specimen of *Hybodus acutus*, Agassiz, described and figured, *tom. cit.* p. 45, pl. x. figs. 4–6 [3]; Lower Kimmeridge Clay, Shotover, near Oxford. *Egerton Coll.*

P. 2157. Two fragments of nearly similar spines, the larger specimen showing the posterior denticles more clearly separated into two longitudinal series than in the type: Lower Kimmeridge Clay, Kimmeridge Bay, Dorsetshire. *Egerton Coll.*

[1] A fragment from the Upper Corallian of Hanover is also assigned to this species by K. Fricke, Palæontogr. vol. xxii. (1875), p. 390, pl. xxii. fig. 5. See also C. Struckmann, Wealdenbild. Umgegend Hannover (1880), p. 91, pl. iii. fig. 1.

[2] Dorsal fin-spines from Stonesfield are also figured under the names of *H. dorsalis*, *H. apicalis*, and *H. marginatus*, by J. Phillips, Geol. Oxford, p. 178, diagr. xxxviii. figs. 1, 2, 6.

[3] A fragment from the Upper Corallian of Hanover is also assigned to this species by K. Fricke, Palæontogr. vol. xxii. (1875), p. 390, pl. xxii. fig. 6.

41400. Larger distal portion of a dorsal fin-spine, showing the posterior denticles less clearly divided into two series above than below; Lower Kimmeridge Clay, near Weymouth, Dorsetshire. *Purchased*, 1869.

P. 155. Imperfect spine, figured in Damon's 'Geol. of Weymouth,' Append. pl. x. fig. 4; near Weymouth. The bases of the lower posterior denticles are seen distinctly separated into two series; and the form of the transverse section of the upper part of the fragment is altered by the breaking away of the anterior margin. *Purchased*, 1881.

41177, 41222, 41399. Fragments of larger spines, with more numerous lateral longitudinal ridges; near Weymouth. One specimen shows three irregular series of posterior denticles. *Purchased*, 1868–69.

46335. Portions of a spine closely resembling the type specimen of *Hybodus acutus* in size and characters; Kimmeridge Clay, Foxhangers, near Devizes, Wiltshire. *Cunnington Coll.*

(b) *Cephalic Spine.*

41876. Exserted portion of spine; near Weymouth. *Purchased*, 1869.

VI. Purbeck.—The following specimens were all obtained from the neighbourhood of Swanage, Dorsetshire.

(a) *Dorsal Fin-spines.*

33476. Two spines indistinguishable from *H. dorsalis*, Agass., of the Stonesfield Slate. *Purchased*, 1858.

35569. A less perfect similar spine. *Purchased*, 1859.

44847 a. Fragment of a more curved spine, nearly similar. *Presented by Benjamin Bright, Esq.*, 1873.

21346, 24725. A larger more robust spine, and a portion of another. *Purchased*, 1847, 1849.

46908. Similar spine, nearly complete, but wanting posterior denticles. *Purchased*, 1875.

21347–8. Two imperfect crushed spines of the form named *Hybodus strictus*, Agassiz[1]. *Purchased*, 1847.

21974. Two imperfect similar spines. *Purchased*, 1848.

[1] Poiss. Foss. vol. iii. (1837), p. 45, pl. x. figs. 7–9.

28447. A nearly perfect similar spine, the exserted portion measuring 0·08 in length, and exhibiting very prominent lines of growth. *Cunnington Coll.*

44847. More slender nearly perfect spine, of the same type, the exserted portion measuring 0·067 in length.
Presented by Benjamin Bright, Esq., 1873.

48375. Short small spine, probably of the same species.
Purchased, 1877.

P. 2170. A very typical spine of *H. strictus*. *Egerton Coll.*

P. 2835. Three nearly perfect similar spines, and one less complete.
Enniskillen Coll.

P. 2836. Basal half of a slightly larger specimen.
Enniskillen Coll.

P. 2837. Smaller imperfect spine, probably young.
Enniskillen Coll.

(b) *Cephalic Spine.*

P. 2205. Exserted portion, and fragment of the base of a cephalic spine. *Egerton Coll.*

VII. Wealden. (a) *Dorsal Fin-spines.*

2686, 2689. Type specimens of *Hybodus striatulus*, Agassiz, Poiss. Foss. vol. iii. (1837), p. 44, pl. viii. *b*. fig. 1, the largest described as the dorsal fin of a fish allied to *Silurus*, in Mantell's Foss. Tilgate Forest (1827), p. 58, pl. x. fig. 4; Tilgate Forest, Sussex. *Mantell Coll.*

2686 a, 2687, 2689 a, 2703, 2708. Five fragmentary spines, referable to *Hybodus subcarinatus*, Agassiz [1]; Tilgate Forest.
Mantell Coll.

26036, 28418, 28421. Abraded nearly complete specimen, and two fragments of similar spines; Tilgate Forest.
Mantell Coll.

P. 4992. Incomplete spine; St. Leonards, Sussex.
Presented by J. E. Lee, Esq., 1885.

P. 4918. Two fragmentary similar spines; Hastings.
Dawson Coll.

[1] Poiss. Foss. vol. iii. (1837), p. 46, pl. x. figs. 10–12. See also figure in Trans. Geol. Soc. [2] vol. ii. (1829), pl. vi. fig. 9.

(b) *Cephalic Spines.*

2691. Type specimen of *Sphenonchus elongatus*, Agassiz, *tom. cit.* p. 202, pl. xxii. *a*. fig. 18; Tilgate Forest. *Mantell Coll.*

P. 4919. One small spine, the basal portion of another, and the exserted portion of one larger spine; Hastings. *Dawson Coll.*

VIII. CRETACEOUS. (a) *Dorsal Fin-spines.*

47228. Portion of a small spine, with few widely-spaced sharp ribs; Gault, Folkestone. *Gardner Coll.*

30260, 35168, 35352 3, 35461. Nine more or less abraded fragments of spines; Cambridge Greensand, Cambridge. *Purchased.*

P. 2173. Two similar fragments; Cambridge. *Egerton Coll.*

P. 4328. Another fragment: Cambridge. *Enniskillen Coll.*

P. 2830. Large abraded and crushed spine, described under the name of *Hybodus complanatus*, R. Owen, Geol. Mag. vol. vi. (1869), p. 482; Upper Greensand, Maidstone, Kent. *Enniskillen Coll.*

(b) *Cephalic Spine.*

P. 2296. Portion of a spine equalling those of the Liassic Hybodonts in size; Grey Chalk, Dover, Kent. *Presented by Mrs. Burton*, 1882.

The following dorsal fin-spines resembling those of *Hybodus* and *Acrodus* have also been named:—

Hybodus acanthophorus, T. C. Winkler, Archiv. Mus. Teyler, vol. v. livr. 2 (1880), p. 122, pl. vi. figs. 19–21, pl. iii. figs. 22–26.—Keuper; Wurzburg.

Hybodus angulatus, G. von Münster, Beitr. Petrefakt. iv. (1841), p. 141, pl. xvi. fig. 17.—Trias; S.E. Tyrol.

Hybodus dewalquei, H. Forir, Ann. Soc. Géol. Belg. vol. xiv. (1887), p. 29, pl. ii. fig. 1.—Upper Cretaceous; Belgium.

Hybodus eichwaldi, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1853, pt. i. p. 331, pl. vi.; *ibid.* 1855, pt. i. p. 392, pl. ii. —Cenomanian; Government of Kursk, Russia.

Hybodus ensatus, L. Agassiz, Poiss. Foss. vol. iii. (1837), p. 51, pl. ix. fig. 12.—Lower Lias; Lyme Regis.

Hybodus fittoni, W. Dunker, Nordd. Wealdenbild. (1846), p. 67, pl. xiii. fig. 34.—Wealden; N. Germany.

Hybodus furcatostriatus, K. Martin, Zeitschr. deutsch. geol. Ges. vol. xxvi. (1874), p. 819, pl. xxix. figs. 3, 4.—Rhætic; Hildesheim, Hanover.

Hybodus hexagonus, G. von Münster, *op. cit.* iv. (1841), p. 141, pl. xvi. fig. 16.—Trias; S.E. Tyrol.

Hybodus laviusculus, L. Agassiz, *tom. cit.* p. 46, pl. x. figs. 24–26; (?) H. von Meyer & T. Plieninger, Beitr. Pal. Württembergs (1844), p. 108, pl. xii. fig. 67.—Rhætic; Aust Cliff, Bristol, and (?) Würtemberg. [? *Nemacanthus.*]

Hybodus leptodus, L. Agassiz, *tom. cit.* p. 44, pl. x. figs. 2, 3.—Form. and loc. unknown.

Hybodus pleiodus, L. Agassiz, *tom. cit.* p. 45, pl. x. figs. 13–17.—Form. and loc. unknown.

Hybodus punctatus, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. (1881), p. 417, pl. xxii. fig. 2.—Rhætic; Aust Cliff, Bristol.

Leiacanthus falcatus, L. Agassiz, *tom. cit.* p. 55, pl. viii. *b.* fig. 16.—Muschelkalk; Lunéville, E. France.

Leiacanthus (*Hybodus*) *opatowitzanus*, H. von Meyer, Palæontogr. vol. i. (1849), p. 221, pl. xxx. fig. 1.—Muschelkalk; Silesia.

Leiacanthus (*Hybodus*) *tarnowitzanus*, H. von Meyer, *tom. cit.* p. 221, pl. xxx. fig. 2.—Muschelkalk; Silesia.

The so-called *Hybodus panderi* (E. von Eichwald, Leth. Rossica, vol. i. 1860, p. 1603), from the Carboniferous Limestone of the Government of Toula, Russia, is founded upon a spine probably of *Ctenacanthus*.

A small cephalic dermal spine (*Sphenonchus*) from the Trias of Würtemberg, now in the Stuttgart Museum, is named *Ceratodus heteromorphus*, L. Agassiz, Poiss. Foss. vol. iii. (1838), p. 136, pl. xviii. fig. 32. Other spines are figured under the same name by F. A. Quenstedt, Handb. Petrefakt., 3rd edit. (1883), p. 298, pl. xxiv. figs. 9–13.

Some similar spines from the Rhætic Bone-bed of Aust Cliff, near Bristol, are named *Sphenonchus* (*Hybodus*) *obtusus*, J. W. Davis, Quart. Journ. Geol. Soc. vol. xxxvii. (1881), p. 420, pl. xxii. fig. 7. See also T. Webster, Trans. Geol. Soc. [2] vol. ii. p. 35, pl. vi. fig. 8 ("Tooth of fish"), where a Wealden example is noticed.

"*Sphenonchus*" is also recorded from the Lias of Weston, near Bath (Mag. Nat. Hist. n. s. vol. iii. p. 282), and the Wealden of Sandown, Isle of Wight (*ibid.* p. 279).

Genus **ASTERACANTHUS**, Agassiz.

[Poiss. Foss. vol. iii. 1837, p. 31.]

Syn. *Strophodus*, L. Agassiz, *tom. cit.* 1838, p. 116.
Curtodus, H. E. Sauvage, Catal. Poiss. Form. Second. Boulonnais (Mém. Soc. Acad. Boulogne-sur-Mer, vol. ii.), 1867, p. 53.

Principal teeth elongated, irregularly quadrate, with slightly arched, but flattened, crown; symphysial teeth few, relatively large, much arched, without lateral denticles, longitudinally keeled; all superficially ornamented by reticulate markings. Dorsal fin-spines marked by stellate tubercles, sometimes in part fused into short longitudinal ribs; two posterior longitudinal series of denticles placed mesially. Large hook-shaped, semi-barbed spines present upon the head. Notochord persistent.

The teeth and spines have hitherto only been found associated in the type species [1], and it is thus necessary at present to retain the duplicate provisional names for all others. As in the case of *Hybodus* and *Acrodus*, the superficial ornamentation of the dorsal fin-spines is so variable, that no species founded upon these fossils alone can be regarded as satisfactorily defined.

Asteracanthus ornatissimus, Agassiz.

1753. *Snout of some animal of the fish tribe*, H. Baker, Phil. Trans. p. 118, pl. vi.
1837. *Asteracanthus ornatissimus*, L. Agassiz, Poiss. Foss. vol. iii. p. 31, pl. viii.
1838. *Strophodus reticulatus*, L. Agassiz, *tom. cit.* p. 123, pl. xvii.
1838. *Strophodus subreticulatus*, L. Agassiz, *tom. cit.* p. 125, pl. xviii. figs. 5–10.
1846. *Strophodus radiatus*, G. von Münster, Beitr. Petrefakt. vii. p. 47, pl. iii. fig. 14.
1848. *Asteracanthus prussi*, W. Dunker, Palæontogr. vol. i. p. 188, pl. xxvi. fig. 3.
1851. *Asteracanthus ornatissimus*, W. Dunker, Palæontogr. vol. i. p. 316, pl. xxxvii. figs. 1–7.
1855. *Asteracanthus papillosus*, Sir P. Egerton, Figs. and Descrips. Brit. Org. Remains (Mem. Geol. Surv.), dec. viii. no. 3, p. 3.
1861. *Asteracanthus ornatissimus*, A. Wagner, Abh. k. bay. Akad. Wiss., math.-phys. Cl. vol. ix. p. 317.
1864. *Strophodus subreticulatus*, J. Thurmann & A. Etallon, Leth. Bruntrutana. (Nouv. Mém. Soc. Helv. Sci. Nat. vol. xx.) p. 432, pl. lxi. figs. 10, 20.
1864. *Asteracanthus ornatissimus*, R. Damon, Geol. Weymouth, Suppl. pl. x. fig. 2.

[1] Ann. Mag. Nat. Hist. [6] vol. ii. 1888, p. 336, pl. xii.

1868. *Strophodus ratisbonensis*, C. W. von Gümbel, Geogn. Beschreib. Ostbay. Grenzgeb. (Geogn. Beschreib. Königr. Bay., pt. ii.), p. 762, woodc. [1]

1869. *Strophodus medius*, R. Owen, Geol. Mag. vol. vi. p. 193, pl. vii.

1875. *Asteracanthus ornatissimus*, K. Fricke, Palæontogr. vol. xxii. p. 387, pl. xxii. fig. 4.

1875. *Asteracanthus preussi*, K. Fricke, *tom. cit.* p. 388, pl. xxii. fig. 1.

1875. *Strophodus reticulatus*, K. Fricke, *tom. cit.* p. 391, pl. xxi. fig. 16.

1888. *Asteracanthus ornatissimus*, var. *flettonensis*, A. S. Woodward, Ann. Mag. Nat. Hist. [6] vol. ii. p. 336, pl. xii.

Type. Dorsal fin-spine; Paris Museum of Natural History.

The type species, of very large size, the exserted portion of the dorsal fin-spine sometimes attaining a length of 0·48.

Dorsal fin-spines robust, ornamented by relatively large, rounded or elongated, stellate tubercles, of unequal size, generally arranged in longitudinal series, sometimes very irregular, rarely in part fused into short ridges; anterior face rounded, sometimes keeled; posterior face raised into a median longitudinal ridge, with two series of large denticles.

Crowns of the small hindermost teeth, and those of series III., IV. gently rounded, coarsely reticulated, without longitudinal keel, but the most prominent superficial markings often becoming in part nearly parallel and transverse; teeth of series I., II. considerably elevated, prominently keeled in the (? lower) jaw, less so in the opposite, the superficial ornament partly reticulate, but the principal markings more or less transverse and radiating or parallel.

That the dentition named *Strophodus reticulatus* by Agassiz pertains to this species, is proved by specimens from the Oxford Clay, described by the present writer, *loc. cit.*; and the nearly complete dentition of one jaw is made known by the so-called *S. medius*.

Form. & Loc. Lower Oolite: Normandy. Middle Oolite: S. England. Upper Oolite: S. England, N. France, W. Switzerland, and N. and S.W. Germany.

(i.) *Dorsal Fin-spines.*

P. 586. Type specimen of *A. papillosus* described by Egerton, *loc. cit.*; Great Oolite, Caen, Normandy. *Egerton Coll.*

32731–2. Greater portion of a smaller spine, with very large posterior denticles, and the tubercular ornament finer than in the last; also a portion of a spine of similar size, with relatively larger tubercles; Caen. *Tesson Coll.*

[1] This "species" is described as obtained from the Greensand; but Dr. K. A. von Zittel informs the present writer that it was most probably obtained from the underlying Jurassic rocks.

39473–4. Basal halves of two spines, with very numerous elongated tubercles; Lower Oxford Clay, Christian Malford, Wiltshire. *Purchased*, 1865.

P. 461–2. Two specimens figured by Agassiz, *tom. cit.* pl. viii. figs. 7, 8; Kimmeridge Clay, Shotover, near Oxford. *Egerton Coll.*

43157. Nearly complete spine, the exserted portion 0·225 in length; Kimmeridge Clay, Shotover. *Wetherell Coll.*

P. 2545. Imperfect larger spine, the exserted portion about 0·35 in length; Kimmeridge Clay, Ely, Cambridgeshire. *Enniskillen Coll.*

P. 2860 a. Portion of smaller spine; Kimmeridge Clay, Ely. *Enniskillen Coll.*

40318. Distal third of small spine; Kimmeridge Clay, Hartwell, Buckinghamshire. *Purchased*, 1867.

46330. Two fragments; Kimmeridge Clay, Devizes, Wiltshire. *Cunnington Coll.*

47331. Several small fragments; Kimmeridge Clay, Swindon, Wiltshire. *Presented by the Swindon Brick and Tile Co.*, 1876.

50091. Fine, nearly complete spine, measuring 0·43 in length; Kimmeridge Clay, Weymouth, Dorsetshire. *Purchased*, 1879.

45924. Fragment of spine, showing very long base; Kimmeridge Clay, Weymouth. *Purchased*, 1874.

48162. Small spine, nearly complete and well-preserved, some of the tubercles fused into short ridges; Kimmeridge Clay, Sandsfoot, near Weymouth. *Purchased*, 1877.

P. 156. Much abraded small spine, the distal extremity broken away and the preserved termination thus deceptive in form, figured by Damon, *op. cit.*; Kimmeridge Clay, Weymouth. *Purchased*, 1881.

P. 2860. Incomplete small, very robust spine; Kimmeridge Clay, Weymouth. *Enniskillen Coll.*

P. 4682. Distal portion of small spine; Kimmeridge Clay, Weymouth. *Presented by C. Westendarp, Esq.*, 1884.

P. 2210. Two fine spines, somewhat abraded, the exserted portion measuring 0·28 in length; also three fragments: Kimmeridge Clay, Kimmeridge, Dorsetshire. *Egerton Coll.*

25300. Greater portion of an enormous spine, the exserted portion originally about 0·48 in length, and the extremity exhibiting longitudinal ribs, as in *Hybodus*; Kimmeridge Clay, Havre, N. France. *Purchased*, 1850.

32547. Five fragments; Kimmeridge Clay, Vaches Noires, N. France. *Tesson Coll.*

32771. Abraded fragment; Kimmeridge Clay, Boulogne, N. France. *Purchased*, 1857.

P. 2211. Portion of very small spine; Portlandian, Soleure, Switzerland. *Egerton Coll.*

P. 4183. Portion of larger spine; Portlandian, Soleure. *Enniskillen Coll.*

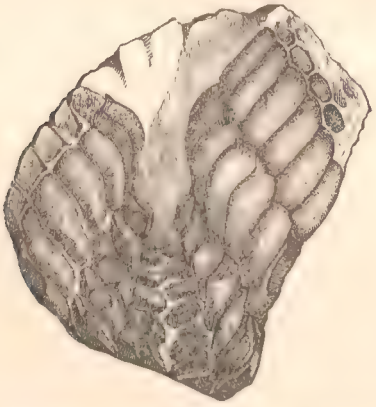
(ii.) *Cephalic Spine.*

32772. Imperfect exserted portion of a large cephalic spine, probably of this species; Kimmeridge Clay, Boulogne. *Purchased*, 1857.

(iii.) *Dentition.*

41378. A large portion of the dentition of the (? upper) jaw, described by Owen (*loc. cit.*) under the name of *S. medius*, and shown, of one third the natural size, in the accompanying woodcut, fig. 11; Great Oolite, Caen, Normandy. *Purchased*, 1869.

Fig. 11.



Dentition of *Asteracanthus ornatissimus* (*Strophodus medius*, Owen).—Great Oolite, Caen. One third nat. size. (No. 41378.)

32532. Three imperfect teeth, probably of this species; Caen. *Tesson Coll.*

41309. Tooth of series IV., wanting root; Great Oolite, Calvados, France. *Purchased* 1869.

22494, 22496. 22658. Six teeth, doubtfully assigned to this species; Corallian, Schnaitheim, Würtemberg. *Purchased*, 1848.

P. 499. Anterior tooth, figured by Agassiz, *tom. cit.* pl. xvii. fig. 5, and five other teeth: Kimmeridge Clay, Shotover, near Oxford. *Egerton Coll.*

P. 2668. Twenty teeth, figured by Agassiz, *tom. cit.* pl. xvii. figs. 1–4, 6–21; Shotover. *Enniskillen Coll.*

P. 2669. Thirty similar teeth; Shotover. *Enniskillen Coll.*

20288. Tooth of series IV.: Kimmeridge Clay, Ely, Cambridgeshire. *Purchased*, 1846.

41221, 41398. Fifteen teeth, including one example of the hindermost series and two of series IV.; Kimmeridge Clay, Weymouth, Dorsetshire. *Purchased*, 1868, 1869.

41874. Four hindermost teeth, two of series IV., and six other teeth; Weymouth. *Purchased*, 1869.

45925. Seven dental crowns; Weymouth. *Purchased*, 1874.

P. 2663. Two principal teeth, one being much abraded, and three imperfect small anterior teeth; Weymouth. *Enniskillen Coll.*

40464, 42103. Five teeth, more or less perfect, from the Neocomian Bone-bed, Potton, Bedfordshire, derived from Kimmeridge Clay. *Purchased.*

46459. Two teeth; Potton. *Cunnington Coll.*

P. 2126. Two imperfect teeth; Portlandian, Soleure, Switzerland. *Egerton Coll.*

P. 5295. Tooth; Upper Jurassic, Switzerland. *Presented by the Duchess of St. Albans*, 1876.

P. 2. Eight more or less fragmentary large teeth, doubtfully assigned to this species; Upper Jurassic, Favara Villabate, Sicily. *Purchased*, 1879.

Var. **flettonensis.** Tubercles upon the dorsal fin-spines comparatively small, fused into ridges distally. Teeth of series IV. narrow; coronal prominence in most teeth well marked.

39475. Fragment of spine; Upper Oxford Clay, Chippenham.
Purchased, 1865.

P. 5881. Plaster cast of cephalic spine, described and figured by the present writer, *loc. cit.* p. 340, pl. xii. figs. 7, 8; Oxford Clay, Fletton, near Peterborough.
Made in the Museum, 1888.

47440. Forty-four associated teeth; Fletton. Two of series IV. are shown, of the natural size, in Plate XV. fig. 14.
Sharp Coll.

I. *Species founded upon detached dorsal fin-spines with which the teeth have not yet been found associated.*

Asteracanthus semisulcatus, Agassiz.

1837. *Asteracanthus semisulcatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 34, pl. viii. *a*. figs. 7, 9, 10 (? fig. 8).
1871. *Asteracanthus tenuistriatus*, J. Phillips, Geol. Oxford, p. 178, diagr. xxxviii. fig. 7.

Type. Imperfect dorsal fin-spine; British Museum.

Dorsal fin-spine about equal in size to that of *A. acutus*, but less laterally compressed and more robust; anterior face rounded, but keeled; posterior face slightly convex, with large denticles. Ornamental tubercles relatively large, elongated, arranged in close series, often fused in part into short ribs.

The teeth of this species are probably described under the name of *Strophodus magnus*, Agassiz.

Form. & Loc. Great Oolite: Oxfordshire.

P. 2855. Type specimen described and figured by Agassiz, *loc. cit.* fig. 7; Stonesfield Slate, Stonesfield. *Enniskillen Coll.*

P. 463. A smaller imperfect spine associated with this species by Agassiz (*loc. cit.* fig. 8), but exhibiting striking resemblances to *A. acutus*; Stonesfield. *Egerton Coll.*

P. 2856–7. Two abraded fragments of spines equal in size to the type, and one imperfect larger specimen; Stonesfield.
Enniskillen Coll.

Asteracanthus acutus, Agassiz.

1837. *Asteracanthus acutus*, L. Agassiz, Poiss. Foss. vol. iii. p. 33, pl. viii. *a*. figs. 1–3.

Type. Distal half of dorsal fin-spine; Bedford Museum.

Dorsal fin-spine attaining a length of about 0·27, much laterally compressed: anterior face keeled; posterior face slightly convex, with large denticles. Ornamental tubercles relatively large, elongated, arranged in close series, rarely fused into ribs in known specimens.

The teeth of this species are probably described under the name of *Strophodus tenuis*, Agassiz.

Form. & Loc. Great Oolite: Oxfordshire. Cornbrash: Northamptonshire. (?) Forest Marble: Dorsetshire.

43616. Much abraded but nearly complete spine, originally measuring about 0·27 in length; Stonesfield Slate, Stonesfield, Oxfordshire. *Purchased*, 1872.

28597. Extremity of spine, with some of the tubercles fused, probably of this species; Stonesfield Slate, Eyeford. *Purchased*, 1853.

P. 5377. Imperfect exserted portion of spine; Great Oolite, Enslow Bridge, Oxfordshire. *Purchased*, 1877.

47131. Incomplete crushed exserted portion of spine: Cornbrash, Botolph's Bridge, Peterborough. *Sharp Coll.*

P. 2853. An imperfect impression of a spine, doubtfully assigned to this species, and labelled *A. stutchburyi*, Agassiz[1], by the Earl of Enniskillen; Forest Marble, near Bridport, Dorsetshire. *Enniskillen Coll.*

Asteracanthus verrucosus, Egerton.

1855. *Asteracanthus verrucosus*, Sir P. Egerton, Figs. & Descrips. Brit. Organic Remains (Mem. Geol. Surv.), dec. viii. pl. ii.

Type. Dorsal fin-spine; Dorchester Museum.

Dorsal fin-spine attaining a maximum length of about 0·32, laterally compressed, not keeled anteriorly; posterior face slightly raised, with two series of large denticles. Ornamental tubercles very numerous, closely arranged, mostly oval in form and disposed

[1] This name is given, without definition, to a fossil said to have been derived from the Lias of Charmouth, Dorset (Poiss. Foss. vol. iii. p. 177).

in longitudinal series, becoming fused into short ribs near the apex.

Teeth unknown.

Form. & Loc. Purbeck Beds: Swanage, Dorsetshire.

23407. Nearly complete small spine, detached from matrix. *Purchased*, 1849.

35571. Crushed spine, 0·3 in length. *Purchased*, 1860.

38496. Broader imperfect spine. *Purchased*, 1864.

40652. Smaller crushed spine. *Purchased*, 1867.

44829. Nearly complete spine, detached from matrix, the extremity abraded. *Presented by Benjamin Bright, Esq.*, 1873.

P. 2209, P. 2209 a. Well-preserved large spine, and a less perfect smaller spine. *Egerton Coll.*

P. 2859. An imperfect large spine, and two smaller specimens, one much abraded. *Enniskillen Coll.*

Asteracanthus granulosus, Egerton.

1855. *Asteracanthus granulosus*, Sir P. Egerton, Figs. & Descrips. Brit. Organic Remains (Mem. Geol. Surv.), dec. viii. pl. i.

1859. *Asteracanthus granulosus*, Pictet & Campiche, Foss. Terr. Crétacé St. Croix, p. 98, pl. xii. fig. 11.

Type. Dorsal fin-spine; British Museum.

Dorsal fin-spine very similar in form and proportions to that of *A. verrucosus*, but with the ornamental tubercles relatively smaller, rounder, and less closely arranged.

Teeth unknown.

Form. & Loc. Wealden: Tilgate Forest, Sussex. L. Neocomian: Switzerland.

P. 565. Type specimen. *Egerton Coll.*

2688, 2704. Two fragments of larger spines, the second figured by Egerton, *loc. cit.* pl. i. figs. 2, 3. *Mantell Coll.*

40166. Plaster cast of fragment described and figured by Pictet and Campiche, *loc. cit.*; L. Neocomian, St. Croix. *Presented by Mons. Campiche*, 1866.

II. *Species founded upon detached teeth not yet correlated with the dorsal fin-spines.*

Strophodus magnus, Agassiz.

1838. *Strophodus magnus*, L. Agassiz, Poiss. Foss. vol. iii. p. 126, pl. xviii. figs. 11–15.

1843. *Strophodus favosus*, L. Agassiz, *tom. cit.* p. 175 (name only).
1871. *Strophodus magnus*, J. Phillips, Geol. Oxford, p. 177, diagr. xxxvii. fig. 7.
1885. *Strophodus favosus*, A. S. Woodward (*ex* Agassiz), Science Gossip, p. 107, fig. 78.
(?) 1886. *Strophodus rigauxi*, H. M. Platnauer, Ann. Rep. Yorkshire Phil. Soc. p. 36, pl. i. figs. 1, 2.

Type. Detached teeth.

Crown of all the teeth gently rounded, those anterior in position exhibiting little or no traces of a longitudinal keel; coronal surface finely reticulated, the more prominent markings becoming straight, parallel, and directly transverse upon the longer margins. In the most posterior series the teeth are small and oval, with very coarse superficial reticulations (Pl. XV. fig. 8); the teeth presumably of series no. IV. are relatively broad and flat (Pl. XV. fig. 7); those of no. III. somewhat longer, the postero-lateral angle gently upturned, and the anterior third of the tooth slightly bent forwards and downwards (Pl. XV. fig. 6). The teeth assumed to belong to series no. II. are broadest posteriorly, with an abrupt hinder margin, the antero-lateral angle produced and the postero-lateral angle rounded (Pl. XV. fig. 5); and the teeth of the most anterior paired series are still smaller than those of no. II., and apparently shorter (Pl. XV. fig. 4).

No median symphysial tooth is recognizable in the Collection.

Form. & Loc. Inferior Oolite: Lincolnshire. Bathonian: Oxfordshire, Northamptonshire, Gloucestershire, Somersetshire, Wiltshire, and N. France.

(i.) *Inferior Oolite.*

47441. Seven teeth of the principal series; Upper Beds of the Lincolnshire Limestone, Stamford, Lincolnshire. *Sharp Coll.*

(ii.) *Stonesfield Slate, Stonesfield, Oxfordshire.*

26010 a. Much abraded tooth of series IV. *Dixon Coll.*

28599. Nine teeth of series I.–IV.; Eyeford, near Stonesfield. *Purchased*, 1853.

33200. Unabraded tooth of series III. *Hastings Coll.*

33472. Ten flat teeth, more or less abraded. *Purchased*, 1858.

P. 2116–7. Thirteen flat teeth, some extremely abraded, labelled in Agassiz's handwriting. *Egerton Coll.*

P. 2661. Eleven flat teeth, slightly abraded. *Enniskillen Coll.*

P. 5106. Three abraded flat teeth.
Presented by J. E. Lee, Esq., 1885.

P. 5882. Naturally arranged series of the hindermost small oval teeth, shown in Pl. XV. fig. 8. *Purchased.*

P. 2614. Similar tooth. *Enniskillen Coll.*

P. 2119. Two similar examples, one large flat tooth, and seven anterior teeth, labelled by Agassiz *Strophodus favosus.*
Egerton Coll.

(iii.) *Great Oolite.*

18997. Tooth of series IV.; Sewardslee. *Miss Baker's Coll.*

19491. Three teeth of series III., IV.; Weston Favell, Northamptonshire. *Miss Baker's Coll.*

19493. Three abraded fragments; Shutlanger, Northamptonshire.
Miss Baker's Coll.

20926. Six abraded teeth, one probably of series II.; Roade, near Blisworth, Northamptonshire. *Miss Baker's Coll.*

47134. Fourteen more or less abraded teeth, including two anterior; Orton, near Peterborough. *Sharp Coll.*

47135. Tooth of series III.; Buttock's Booth, near Peterborough.
Sharp Coll.

47136. Ten flat teeth and one anterior tooth; Kingsthorpe, Northamptonshire. *Sharp Coll.*

P. 2660. Fourteen teeth, two with nearly perfect roots; Orton, near Peterborough. *Enniskillen Coll.*

P. 2118. Fifteen fragmentary and abraded teeth; Cairnscross, Stroud, Gloucestershire. *Egerton Coll.*

P. 4169. Twelve imperfect teeth; Cairnscross. *Enniskillen Coll.*

P. 5883. Four teeth; Minchinhampton, Gloucestershire. *Byne Coll.*

P. 4173. Two flat teeth and one anterior tooth; Melksham, Wiltshire. *Enniskillen Coll.*

(iv.) *Forest Marble.*

28440. Forty teeth, some scarcely abraded, of all series, two anterior teeth shown in Pl. XV. figs. 4, 5; Stanton, Wiltshire. *Cunnington Coll.*

30552. Thirteen flat teeth; Atford, near Bath. *Purchased*, 1856.

30564–68. Two hindermost teeth, one of series IV., two of series III., and a much abraded tooth of series II.; Atford.
Purchased, 1856.

P. 2659, P. 2659 a, b. Twenty-four teeth, mostly flat, but five referable to an anterior series; Atford. A tooth of series IV. is shown in Pl. XV. fig. 7, and another of series III. in Pl. XV. fig. 6. *Enniskillen Coll.*

32353. Tooth of series IV.; Malmesbury, Wiltshire.
Purchased, 1857.

40535. Two flat teeth; Wiltshire. *Purchased*, 1867.

(v.) *Cornbrash.*

47132. Thirteen teeth of small size; Botolph's Bridge, near Peterborough. *Sharp Coll.*

47133. Nine teeth, mostly larger; near Peterborough. *Sharp Coll.*

Strophodus tenuis, Agassiz.

1838. *Strophodus tenuis*, L. Agassiz, Poiss. Foss. vol. iii. p. 127, pl. xviii. figs. 16–25.
1858. *Strophodus tenuis*, F. A. Quenstedt, Der Jura, p. 340, pl. xlvi. figs. 12, 13.
1871. *Strophodus tenuis*, J. Phillips, Geol. Oxford, p. 177, diagr. xxxvii. fig. 9.

Type. Detached teeth.

Teeth long and narrow, the crown in all except the hindermost rows and series IV. considerably elevated; anterior teeth much arched, with a longitudinal keel, superficial coronal ornament as in *S. magnus*, except in the anterior teeth. Of the hindermost series, the teeth are small and oval; those of series no. IV. (Agass., fig. 21) seem to be only gently rounded; and those of no. III. (Agass., figs. 17–20) are much longer than the latter, the crown raised and tumid at one half or one third the distance from its anterior extremity, and bent downwards and forwards in front. The teeth presumably referable to series no. II. (Agass., figs. 22, 23) are much elevated mesially, slightly keeled, and narrowed at each extremity, though especially in front; and those of the most anterior paired series (Agass., figs. 24, 25) are strongly arched, the apex of the crown being a blunt point and the longitudinal keel prominent. There is also evidence of a high-crowned median symphysial row of teeth in one of the jaws.

Form. & Loc. Bathonian: Oxfordshire (Stonesfield Slate), Northamptonshire, Lincolnshire, Gloucestershire, and Wiltshire. Brown Jura β: Würtemberg.

(i.) *Stonesfield Slate, Stonesfield, Oxfordshire.*

11046. Fine tooth of series III. *Mantell Coll.*

33472 a, 33473, 35497. Nine teeth, including one posterior oval and two anterior raised examples. *Purchased*, 1858, 1860.

36315. Three teeth; Eyeford, near Stonesfield. *Daniels Coll.*

P. 2120. Eight teeth, including a fine example of series III. and three anterior teeth, five being labelled by Agassiz. *Egerton Coll.*

P. 4632. Six small teeth. *Enniskillen Coll.*

(ii.) *Great Oolite.*

47442. Abraded tooth of series II., and two fragments: Great Oolite, Stamford, Lincolnshire. *Sharp Coll.*

47442 a. Three imperfect anterior teeth; Great Oolite, Kingsthorpe, Northamptonshire. *Sharp Coll.*

P. 4173 a. Two anterior teeth; Melksham, Wiltshire. *Enniskillen Coll.*

(iii.) *Cornbrash.*

P. 2662. Six abraded imperfect teeth; Peterborough. *Enniskillen Coll.*

47132 a. Raised tooth of large size; Botolph's Bridge, near Peterborough. *Sharp Coll.*

(iv.) *Forest Marble.*

47964. Two associated teeth, one of series I., the other of series III.; near Oxford. *Presented by the Hon. Robert Marsham*, 1877.

28440 a. Eighteen teeth, of the anterior series and no. III.; Stanton, Wiltshire. *Cunnington Coll.*

30558, 30562. Three teeth, series III., IV.; Atford, near Bath. *Purchased*, 1856.

30553–4. Three anterior raised teeth and one of series III., three being very large and provisionally assigned to this species, and one of the raised teeth symmetrical; Atford. *Purchased*, 1856.

46339. Two teeth, series II., III.; Atford. *Cunnington Coll.*

P. 5885. Four flat teeth; (?) Atford. *Byne Coll.*

P. 5884, P. 5884 a, b. Twenty-five teeth of series I., II., two shown in Pl. XV. figs. 2, 3; (?) Atford. *Byne Coll.*

P. 5891. Three large anterior teeth, one symmetrical; Chippenham, Wiltshire.

41295. Two teeth, series III.; Box, Wiltshire. *Purchased*, 1869.

P. 2115 a. Four anterior teeth, and one of series III. *Egerton Coll.*

P. 4172 a. Two anterior teeth. *Enniskillen Coll.*

Strophodus lingualis, sp. nov. (*ex* Phillips).

1871. *Strophodus lingualis*, J. Phillips, Geol. Oxford, p. 177, diagr. xxxvii. fig. 8 (fig. only).

Type. Detached tooth; Oxford Museum.

The following teeth appear to belong to the same species as the tooth from the Stonesfield Slate figured by Phillips (*op. cit.*), without description, under the name of *Strophodus lingualis*. They are of very small size, the principal teeth narrow and not measuring more than 0·018 in length; the coronal surface is very coarsely reticulated, the transverse markings being especially prominent; and there is occasionally a longitudinal ridge.

Form. & Loc. Bathonian: Oxfordshire and Wiltshire.

28600. Two longitudinally ridged teeth, one having a single eminence near one extremity (Pl. XV. fig. 11), the other having two (Pl. XV. fig. 10); Stonesfield Slate, Eyeford. *Purchased*, 1853.

11158. A broader flatter tooth (Pl. XV. fig. 9); Stonesfield Slate, Stonesfield. *Mantell Coll.*

P. 2121. Two teeth longitudinally ridged; Stonesfield. *Egerton Coll.*

P. 2665. Flatter, worn tooth; Stonesfield. *Enniskillen Coll.*

32356. Slightly ridged tooth (Pl. XV. fig. 12); Forest Marble, Malmesbury, Wiltshire. *Purchased*, 1857.

The following tooth, from the Forest Marble of Stanton, Wiltshire, is also probably referable to a species of *Asteracanthus*:—

P. 5886. Tooth probably of series III., measuring 0·035 in length the crown raised mesially, and marked by coarse feather-like reticulations (Pl. XV. fig. 13). *Cunnington Coll.*

The supposed tooth (**4158**, *Mantell Coll.*) from the Chalk of Lewes, named *Strophodus asper*, Agassiz (Poiss. Foss. vol. iii. p. 128 *b*. pl. x. *b*. figs. 1–3), is a fragment of a Crustacean.

The following species have also been named, but there appear to be no examples in the Collection :—

(i.) *Dorsal Fin-spines.*

Asteracanthus lepidus, A. Dollfuss, Faune Kimm. Cap De La Hève (1863), p. 34, pl. ii. figs. 1–7.—Kimmeridgian ; Cape De La Hève.

Asteracanthus minor, L. Agassiz, Poiss. Foss. vol. iii. (1837), p. 33, pl. viii. *a*. figs. 4–6.—Form. and loc. unknown.

Asteracanthus semiverrucosus, Sir P. Egerton, Figs. and Descrips. Brit. Org. Remains (Mem. Geol. Surv. 1855), dec. viii. pl. iii.—Purbeckian ; Swanage, Dorset.

Asteracanthus tetrastichodon, K. Fricke, Palæontogr. vol. xxii. (1875), p. 389, pl. xxii. fig. 2.—Upper Corallian ; Hanover.

Asteracanthus vastensis, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. viii. p. 454, pl. xiv. fig. 5.—U. Callovian ; Boulogne-sur-Mer.

The so-called *Asteracanthus siderius*, J. Leidy (Proc. Acad. Nat. Sci. Philad. 1870, p. 13, and Rep. U. S. Geol. Surv. vol. i. pt. i. (1873), p. 313, pl. xxxii. fig. 59), from the Sub-Carboniferous of Tennessee, certainly does not belong to this genus.

(ii.) *Teeth.*

Strophodus beaugrandi, H. E. Sauvage, Catal. Poiss. Secondaires Boulonn. (Mém. Soc. Acad. Boulogne-sur-Mer, vol. ii. 1867), p. 52, pl iii. fig. 6.—Kimmeridgian ; Boulogne-sur-Mer.

Strophodus corallinus : *Curtodus corallinus*, H. E. Sauvage, *op. cit.* p. 53, pl. iii. fig. 8.—Corallian ; Boulogne-sur-Mer.

Strophodus hamii, H. E. Sauvage, *op. cit.* p. 52, pl. iii. figs. 4, 5 : *Acrodus elegans*, H. E. Sauvage, *ibid.* p. 54, pl. iii. fig. 9.—Bathonian ; Marquise, Boulonnais.

Strophodus irregularis, L. Agassiz (*ex* Münster, MS.), *tom. cit.* (1838) p. 127, pl. xviii. fig. 26.—Lower Oolite ; Bavaria.

Strophodus longidens, L. Agassiz, *tom. cit.* p. 117, pl. xvi.—Bathonian ; Caen, Normandy.

Strophodus nebrodensis, G. G. Gemmellaro, Studi Paleont. Fauna Calc. a *Terebratula janitor* N. Sicilia, pt. i. (1868–76), p. 10, pl. i. figs. 48–56.—Jurassic ; N. Sicily.

Strophodus normanianus, A. Dollfuss, Faune Kimm. Cap De La Hève (1863), p. 33, pl. i. figs. 3–16.—Kimmeridgian ; Cape De La Hève. [?=*Asteracanthus lepidus*, Dollfuss.]

Strophodus personati, F. A. Quenstedt, Der Jura (1858), p. 339, pl. xlvi. fig. 15.—Brown Jura β ; Würtemberg.

Strophodus punctatus, L. Agassiz (*ex* Münster MS.), *tom. cit.* p. 128 *b*, pl. xxii. figs. 1, 2.—Cenomanian; Kelheim, Bavaria.

Strophodus radiato-punctatus, L. Agassiz, *tom. cit.* p. 128, pl. xviii. fig. 27.—Callovian: Yorkshire.

Strophodus tridentinus, K. A. von Zittel, Fauna Aelt. Cephalopodenführ Tithonbild. (Suppl. to Palæontogr. 1870), p. 24, pl. i. fig. 2.—Tithonian; Trient, Tyrol.

Teeth of *Strophodus* are also figured and noticed by Pictet and Campiche, Foss. Terr. Crétacé St. Croix (1858), p. 92, pl. xii. figs. 1–6 (Lower Neocomian) and p. 24 (Aptian); and by G. G. Gemmellaro, Studi Paleont. Calc. a *Terebratula janitor*, pt. i. (1868–76), p. 9, pl. i. figs. 35–47.

Genus **BDELLODUS**, Quenstedt.

[Württ. Jahresh. vol. xxxviii. 1882, p. 137.]

Teeth quadrate, with slightly arched, but flattened crown, superficially ornamented by reticulate markings. Symphysial teeth few. Teeth of series I. to III. scarcely increasing in size, those of series IV. relatively very large and elongated. Dorsal fin-spines unknown.

Bdellodus bollensis, Quenstedt.

1882. *Bdellodus bollensis*, F. A. Quenstedt, Wurtt. Jahresh. vol. xxxviii. p. 137, pl. iii.

Type. Associated upper and lower dentition; Tübingen University Museum.

Anterior teeth tumid, not keeled; those of series IV. five times as long as these.

Form. & Loc. Upper Lias: Boll, Würtemberg.

Genus **PALÆOSPINAX**, Egerton.

[Figs. and Descrips. Brit. Organic Remains (Mem. Geol. Survey, 1872), dec. xiii. no. vii.]

Body long and slender; the first dorsal fin opposite the space between the pectorals and pelvics, the second partly in advance of, partly opposite, the anal. Dentition comparatively specialized, the anterior teeth being high-crowned and prehensile, those placed posteriorly having the cusps reduced to minute beads and adapted for crushing. Symphysial teeth with a single pair of lateral denticles, other teeth with two or three. Dorsal fin-spines smooth, the sides covered with a dense layer of ganoine, sometimes forming isolated tubercles immediately above the inserted portion; posterior denticles

absent. Shagreen fine, dense; no cephalic spines; large dermal hooks upon the claspers of the male. Vertebræ cyclospondylic, sometimes feebly asterospondylic.

Palæospinax priscus (Agassiz).

1843. *Thyellina prisca*, L. Agassiz, Poiss. Foss. vol. iii. p. 378, pl. xxxix. figs. 1, 2.
1872. *Palæospinax priscus*, Sir P. Egerton, Figs. & Descrips. Brit. Organic Remains (Mem. Geol. Surv.), dec. xiii. pl. vii.
1873. *Palæospinax priscus*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. xxix. p. 420.
1881. *Palæospinax priscus*, J. W. Davis, Ann. Mag. Nat. Hist. [5] vol. vii. p. 429, pl. xx.
1883. *Palæospinax priscus*, C. Hasse, Neues Jahrb. vol. ii. p. 66.
1884. *Cestracion* (*Acrodus*), C. Hasse, Palæontogr. vol. xxxi. p. 6, pl. ii. figs. 8, 9.
1888. *Palæospinax priscus*, A. S. Woodward, Geol. Mag. [3] vol. v. p. 499.

Type. Vertebral column and shagreen.

The type species, of small size. Principal cusp of the anterior teeth much attenuated. Shagreen-granules often striated; dermal spines of claspers forked.

Form. & Loc. Lower Lias: Lyme Regis, Dorsetshire.

P. 3189. Head and anterior portion of the trunk, described and figured by Egerton, Mem. Geol. Surv. dec. xiii. pl. vii. figs. 1, 4–6. *Enniskillen Coll.*

P. 3190. Mandible and dentition, described and figured by Egerton, *loc. cit.* pl. vii. figs. 2, 7, 8. The posterior tooth is not so smooth as shown in fig. 8, the crown having a more beaded appearance, as in *Synechodus*. *Enniskillen Coll.*

P. 3192. Imperfect vertebral column, with shagreen, half of the pectoral arch, and the broken second dorsal fin-spine, referred to by Egerton, *loc. cit.* *Enniskillen Coll.*

P. 1297. Crushed and obscure remains of a complete fish, the outlines not being recognizable. The specimen is described by Egerton in the Quart. Journ. Geol. Soc. vol. xxix. p. 420, and shows the relative positions and proportions of the two dorsal fin-spines. Both spines (especially the first) are considerably worn obliquely at the distal end, and Egerton points out that in situation they agree more closely with those of *Cestracion* than with those of *Acan-*

thias. The difference between the anterior and posterior teeth is well shown, and most of the examples exposed are delicately striated. The pectoral arch is slender, each upper extremity tapering to a fine point: and in the expansions of the pectoral, pelvic, and first dorsal fins there are traces of delicate exoskeletal supporting-fibres. The fine shagreen-granules are more or less quadrate in form, apparently all striated. *Egerton Coll.*

P. 3193. A less complete male individual, much crushed and broken, but preserved as far as the second dorsal spine. The few scattered teeth have mostly smooth crowns. The two dorsal fin-spines are comparatively small and much abraded distally: and some of the shagreen-granules are smooth, though the majority exhibit prominent striations. Exoskeletal fibres are also seen in the pectoral and first dorsal fins, and indications of large spines occur at the extremities of the pelvic claspers. *Enniskillen Coll.*

P. 1296. Half of the abdominal region and the nearly complete tail, laterally compressed, and mostly exhibiting a definite outline, shown of two thirds the natural size in Pl. VII. fig. 1. The body and fins are enveloped in dense shagreen, the granules being especially large and thick upon the upper border of the tail, and here smooth externally, having only dentated margins. The shagreen in most parts, however, is fine, and the majority of the granules appear to be striated. The position of the pelvic fins is indicated by the remains of claspers with large dermal spines (*d.*) at the extremities: but the precise characters of the latter are not certainly distinguishable. Each clasper appears to be provided with two bifurcating spines in contact at their base, which is expanded and flattened upon the apposed side: and, as shown in the figure, the exserted portion of each of these consists of two compressed divergent branches, gently curved, and unequal in size. The second dorsal fin (*d.*²) is placed opposite a point about midway between the pelvics and the caudal; and the spine is relatively small, its exserted portion not extending along more than one third the length of the anterior border of the fin. Distinct indications of an anal fin (*a.*) are to be observed opposite the posterior two thirds of the second dorsal, but the outline is unfortunately destroyed.

The caudal fin (*c.*) is also imperfect, but evidently large and powerful. *Egerton Coll.*

P. 3194. Portion of a vertebral column, comprising about twenty-eight centra, with shagreen and a dorsal spine. *Enniskillen Coll.*

P. 3195. Series of thirteen vertebræ. *Enniskillen Coll.*

P. 1299. Series of about twenty-nine vertebræ. *Egerton Coll.*

P. 3191. Anterior dorsal fin-spine, figured by Egerton, *loc. cit.* pl. vii. fig. 3, and said to pertain to another fossil in the Enniskillen Collection not now identifiable, unless it be No. P. 3194, inaccurately described. *Enniskillen Coll.*

P. 1298. A larger remarkably straight dorsal spine. *Egerton Coll.*

47463. A complete spine, unabraded, long and straight. *Purchased*, 1876.

Palæospinax egertoni, sp. nov.

1873. *Palæospinax* (?), Sir P. Egerton, Figs. & Descrips. Brit. Organic Remains (Mem. Geol. Surv.), dec. xiii. no. vii. p. 3.

Type. Crushed head, teeth, and vertebræ; British Museum.

The unique specimen mentioned below may be referred with much probability to the genus *Palæospinax*, and indicates a larger species than *P. priscus*, characterized by the relatively greater breadth of the median cone in the anterior teeth, and the smoothness of the shagreen-granules, of which the margins are sometimes so much indented as to give them a stellate appearance.

Form. & Loc. Lower Lias: Würtemberg.

P. 1132. A vertically crushed head and the anterior portion of the vertebral column, with shagreen, a few prehensile teeth, and a displaced cartilage, to be regarded either as the left mandibular or ceratohyal; Ohmden, Würtemberg. The head must have been originally at least 0·075 in length, and the snout is obtusely rounded. The anterior teeth are quite smooth, showing only the slightest traces of vertical wrinkles at the base, and the median cone is relatively broad, gradually tapering to a very sharp point; a single prominent broad lateral denticle occurs on each side. The shagreen-granules are largest towards the end of the snout, smooth, and more or less quadrate, but often deeply indented on two or more borders, thus assuming

an almost stellate appearance. On the right side, immediately behind the head, four or five faint transverse grooves in the shagreen-investment appear to mark the gill-slits, diminishing in size backwards. *Egerton Coll.*

A fragmentary example of *Palæospinax* from the Lias of Holzmaden, Würtemberg, now in the Stuttgart Museum, seems to differ from both of the described species. Detached teeth and dorsal fin-spines of an undetermined species have also been discovered in the Rhætic of Holwell, Frome, Somersetshire (Moore Collection, Bath Museum).

Genus **SYNECHODUS**, A. S. Woodward.

[Proc. Geol. Assoc. vol. x. 1888, p. 288.]

A genus, so far as known, scarcely differing from *Palæospinax* except in its higher degree of specialization. The pterygo-quadrate cartilage in the adult is directly connected with the cranium by a postorbital articulation [1], and the vertebræ are distinctly asterospondylic. None of the teeth have less than two lateral denticles, these being generally numerous; all are in part delicately striated, and at the base of the crown the ornament is often reticulate.

The complete dentition of one jaw of the type species of this genus is made known by a fine fossil, from the Chalk of Sussex, preserved in the collection of Henry Willett, Esq., Brighton Museum. About 140 teeth are displayed in their natural relative positions; and the specimen is shown, of twice the natural size, in the accompanying woodcut (fig. 12), with the first and second teeth and one of each of the alternate succeeding series, still further enlarged separately. There are eleven dental series upon either ramus of the jaw, each of those posteriorly placed comprising as many as eight or nine teeth, while those near the symphysis have not more than six. There is no median symphysial row of teeth, and the first pair (I.) is extremely small. In the latter the principal coronal cusp is long and slender, its height being equal to the entire width of the tooth; and there are two small denticles in front and one behind. The teeth of series II. are nearly four times as wide as those of no. I., with the principal coronal cusp still very prominent and flanked in front and behind by three large denticles and one smaller point, of which those behind are the more widely spaced. The teeth of series III. are very similar to those of no. II.; but in the teeth of series IIII. and V. the principal cusp rapidly becomes

[1] Proc. Zool. Soc. 1886, p. 218, pl. xx. figs. 1, 2.

Fig. 12.

Dentition of *Sp[illegible]dabrisiensis*, Mackie sp.; Chalk, Sussex.

[Collection of Henry Willett, Esq., F.G.S., Brighton Museum.]

stouter and less elevated, and there are five denticles in front, while only three or four can be distinguished behind. In series VI. to IX. the size of the teeth only gradually decreases backwards, but the principal cusp becomes very short and stout, thus more resembling the lateral denticles, which are still very numerous and placed well apart. In these teeth the denticles are five or six in number, both in front and behind. In series X. the teeth are only about two thirds as wide as those of no. IX., while those of series XI. are still smaller by one half; and in both of these all the coronal prominences have become insignificant, though yet faintly indicated by a beaded contour. The base of the crown in all the teeth is marked by fine reticulating wrinkles, and the lower portion of the coronal cusps is often vertically striated.

On comparing the teeth of this fossil with the few examples of *S. dubrisiensis* already described, one important difference will at once be noted. Whereas in Mr. Willett's specimen the most anterior teeth are very small and delicate, some other fossils exhibit teeth in a corresponding position of a very large and robust character, with several feebly-marked denticles on each side[1]. One specimen noticed below (No. 41675) suggests that the latter pertain to the upper jaw; and in that case the Brighton fossil may represent the lower dentition. There can be no doubt, indeed, that the two types belong to one and the same species: but whether the differences in the anterior teeth depend merely upon their pertaining to one or the other jaw, or whether one type is referable to the male and the other to the female, remains yet to be determined. The present writer has examined no specimen in which the small teeth and the robust teeth occur together.

Synechodus dubrisiensis (Mackie).

1863. *Hybodus dubrisiensis*, S. J. Mackie, Geologist, vol. vi. p. 241, pl. xiii.

1886. *Hybodus* (?) *dubrisiensis*, A. S. Woodward, Proc. Zool. Soc. p. 218, pl. xx.

1888. *Synechodus dubrisiensis*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 288.

1888. *Synechodus dubrisiensis*, A. S. Woodward, Geol. Mag. [3] vol. v. p. 496, woodcut.

Type. Jaws with dentition; British Museum.

Supposed upper anterior teeth robust, the coronal surface prominently striated almost to the apex, and the lateral denticles three

[1] Proc. Zool. Soc. 1886, pl. xx. fig. 3 *a*.

or four in number and small; base-line of crown gently arched. Supposed lower anterior teeth very minute, with well-separated lateral cusps.

Form. & Loc. Chalk: Kent.

36908. Type specimen, described, with a very imperfect figure, by Mackie, *loc. cit.*; Lower Chalk, Dover. *Purchased*, 1862.

41675. Nearly complete mandibular and hyoid arches, with a portion of the right (? upper) dentition, and a few teeth on the left, described and figured by the present writer, Proc. Zool. Soc. 1886, p. 218, pl. xx.; Kent. The pterygo-quadrate measures about 0·075 in length, and exhibits a facette for a postorbital articulation with the cranium; the hyoid arch is notably slender. An anterior tooth, probably of the upper jaw, is shown, of three times the natural size, in Pl. XI. fig. 17, and a posterior tooth, similarly enlarged, in fig. 20. *Toulmin Smith Coll.*

47287. Fragments of cartilage associated with shagreen and a few teeth; Lower Chalk, Dover. One tooth, representing about the fourth lateral series, is shown, of three times the natural size, in Pl. XI. fig. 18, and another, of about the sixth series, similarly enlarged, in Pl. XI. fig. 19. The shagreen-granules are marked by prominent ridges, terminating in a denticulated margin. *Gardner Coll.*

41909. Fragments of jaws, with a few teeth, mostly of the upper anterior series; (?) Burham. *Mrs. Smith's Coll.*

49032. Imperfect remains of the head, pectoral arch, and the anterior half of the vertebral column, exposed from beneath, noticed by the present writer, Proc. Zool. Soc. 1886, p. 223. The base of the cranium exhibits a longitudinal raised line, evidently the remains of the primitive investment of the notochord; each half of the pectoral arch is long, slender, and tapering distally; and the vertebræ are asterospondylic, a few being shown, of the natural size, in Pl. XII. fig. 6. *Mrs. Smith's Coll.*

43124. Anterior upper tooth; Gravesend. *Wetherell Coll.*

P. 4100. Minute anterior upper tooth, doubtfully referable to this species; near Margate, Kent.

Presented by Sydney C. Cockerell, Esq., 1883.

49960. An imperfect antero-lateral tooth, doubtfully referable to *S. dubrisiensis*; Glynde, Sussex. *Capron Coll.*

P. 1295. Remains of a large head, the pterygo-quadrate cartilage originally measuring about 0·11 in length; Snodland, Kent. Several teeth are preserved, and only differ from those of *S. dubrisiensis* in the remarkable smoothness of their coronal surface; the shagreen-granules resemble those of this species; and the fragmentary cartilages also exhibit no notable differences. It thus seems probable that the fossil pertains to *S. dubrisiensis*, and indicates the large size to which this fish sometimes attained.

Egerton Coll.

Synechodus tenuis, sp. nov.

Type. Detached anterior tooth, shown in Pl. XI. fig. 21.

Coronal cusp of the large anterior teeth more slender and produced than in the type species, the superficial wrinkles less conspicuous, and apparently confined to the basal portion of the crown; base-line of the crown much arched.

Form. & Loc. Neocomian: Kent.

9297. The type specimen, shown, of three times the natural size, in Pl. XI. fig. 21, and two less perfect teeth; Lower Greensand, Maidstone. *Mantell Coll.*

39218. Tooth; Maidstone. *Bowerbank Coll.*

Synechodus recurvus (Trautschold).

1877. *Sphenodus recurvus*, H. Trautschold, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 335, pl. v. fig. 4.

Type. Detached anterior tooth.

The specimens mentioned below indicate a large species, with the teeth of the anterior half of the jaw so similar to those of *Synechodus* that it may be provisionally associated with this genus. The principal cone is high and compressed, and all the lateral cones slender, pointed, and well separated; superficial ornament confined to short vertical wrinkles at the base of the crown. The base-line of the dental crown is almost straight, and the anterior margin of the flattened root crimped.

If the generic determination be correct, the most posterior teeth still remain unknown.

Form. & Loc. Cenomanian: S. Russia. Gault: Kent.

P. 5562. Two fragmentary teeth; Cenomanian, Saratov, Russia.

By exchange, 1888.

47220 a, 47220 b. Two specimens, shown, of the natural size, in Pl. XI. figs. 22, 23; Gault, Folkestone. *Gardner Coll.*

47220 c, 47220 d. Two smaller teeth, one anterior, one from the side of the jaw; Gault, Folkestone. *Gardner Coll.*

39219. Tooth as large as the type specimens, but less elevated and referable to a more posterior situation in the jaw; Gault, Folkestone. *Bowerbank Coll.*

Synechodus sulcatus (Davis).

1888. *Odontaspis sulcata*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 25, pl. v. figs. 11–13.

1888. *Synechodus sulcatus*, A. S. Woodward, Geol. Mag. [3] vol. v. p. 499.

Type. Detached teeth; Colonial Museum, Wellington, New Zealand.

A species known only by the lateral teeth, which are much compressed. The cones are well separated, each having a broad base and an elongated slender extremity; and the lower half in all is marked by a few widely-spaced vertical wrinkles.

Form. & Loc. Cretacco-Tertiary (Black Grit Series): Amuri Bluff, New Zealand.

P. 2314. Imperfect dental crown. *By exchange*, 1876.

Undetermined species of *Synechodus* are indicated by the following teeth:—

48954. Anterior tooth, measuring 0·008 from side to side, and half of a tooth of corresponding size from the middle of the ramus of the jaw; Upper Chalk, Norwich. The teeth are very suggestive of *S. dubrisiensis*, but are distinguished by the breadth and compression of the lateral denticles. *Bayfield Coll.*

P. 5846. A still larger anterior tooth, measuring 0·009 from side to side, differing from the foregoing in its much greater height and the smoothness of the coronal surface; Upper Chalk, Norwich. *Presented by B. B. Woodward, Esq.*, 1888.

48953. Anterior tooth much resembling that of *S. recurvus*, but somewhat larger, and with the lateral cones more divergent; shown, of the natural size, in Pl. XII. fig. 7; Upper Chalk, Norwich. *Bayfield Coll.*

P. 5847. A less perfect similar tooth; Upper Chalk, Norwich.

P. 5834. Imperfect small tooth; Craie phosphatée, Ciply, near Mons, Belgium.

Presented by Mons. A. Houzeau de Lehaie, 1888.

Several teeth of *Synechodus*, from the Lower Plänerkalk of Weisskirchlitz, Bohemia, have been described by A. E. Reuss, Verstein. böhm. Kreideform. pt. ii. 1846. They have received the following seven names, but cannot be regarded as representing so many species:—*Hybodus brannii* (p. 97, pl. xxiv. fig. 26, pl. xlii. fig. 7); *H. dispar* (p. 98, pl. xxiv. figs. 27, 28); *H. gracilis* (p. 98, pl. xxi. figs. 12, 13); *H. polyptychus* (p. 97, pl. xxi. figs. 9, 10); *H. regularis* (p. 98, pl. xxi. fig. 11); *H. serratus* (p. 98, pl. xxi. figs. 14, 15); and *H. tenuissimus* (p. 98, pl. xxi. figs. 16, 17). Of all of these, figures are also given by A. Fritsch, Rept. u. Fische böhm. Kreideform. 1878, p. 6, figs. 7, 8 (woodcuts), p. 13, figs. 28–32 (woodcuts); and *H. gracilis* is noticed by C. E. Fischer, Allg. deutsch. Naturh. Zeitung, n. s. vol. ii. (1856), p. 140, pl. ii. fig. 35. *H. regularis* and *H. gracilis* are considered to be the young of "*Otodus sulcatus*" by H. B. Geinitz, Palæontogr. vol. xx. pt. i. (1875), p. 294, and by A. Fritsch, *op. cit.*

Genus **CESTRACION**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 129.]

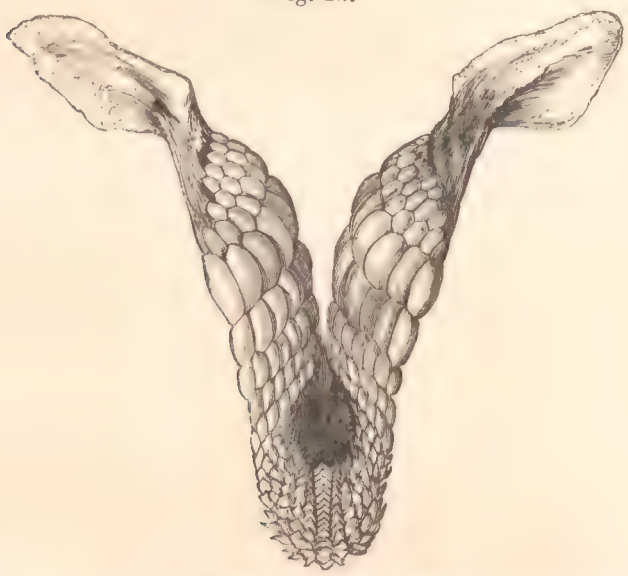
Syn. *Heterodontus*, A. D. de Blainville, Bull. Soc. Philom. 1816, p. 121[1].
Tropidodus, T. Gill, Proc. Acad. Nat. Sci. Philad. 1862, p. 489.
Gyropleurodus, T. Gill, *loc. cit.* p. 489.
Drepanophorus, Sir P. Egerton, Figs. & Descrips. Brit. Organic Remains (Mem. Geol. Surv. 1872), dec. xiii. no. ix.

Body moderately elongated; the first dorsal fin opposite to the space between the pectorals and pelvics, the second in advance of the anal. Mouth terminal or nearly so. Dentition (fig. 13), specialized; the anterior teeth small, numerous, cuspidate, generally with at least one pair of lateral denticles: principal teeth without cusps, but relatively broad and flattened, having a slight longitudinal keel and a more or less reticulate ornamentation. Dorsal fin-spines smooth, the sides covered with a dense layer of ganoine; posterior denticles absent. Shagreen fine; no cephalic spines; no large dermal hooks upon the claspers of the male. Vertebræ well developed, asterospondylic.

[1] This name being prior to *Cestracion*, it is frequently employed in systematic works; it is, however, preoccupied by *Heterodon*, Palisot de Beauvois (in Latreille, Rept. vol. iv. 1800, p. 32), applied to a recent Ophidian.

The jaw shown in the accompanying woodcut (fig. 13), is sometimes termed upper [1], and sometimes lower [2]. In his latest remarks upon the subject, Sir Richard Owen states that it represents the lower dentition, which differs from the upper in the presence of an azygous series of symphysial teeth. So far, however, as the present writer has had the opportunity of observing, this character is not constant.

Fig. 13.



Jaw of *Cestracion philippi*.—Recent.

In the living species the pterygo-quadrate cartilage articulates with the preorbital region of the cranium, but it is impossible to determine whether such was the case in the extinct species here referred to the same genus.

Cestracion falcifer, Wagner.

1852. *Cestracion*, F. A. Quenstedt, Handb. Petrefakt. p. 178.
1857. *Cestracion falcifer*, A. Wagner, Gelehr. Anz. bay. Akad. Wiss. vol. xliv. p. 290.
1863. *Acrodus falcifer*, A. Wagner, Abh. k. bay. Akad. Wiss., math.-phys. Cl. vol. ix. p. 301, pl. v. fig. 1.

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[1] R. Owen, Palæontology, 2nd edit. (1861), p. 127, fig. 41.
[2] R. Owen, Geol. Mag. vol. vi. (1869), p. 196.

1882. *Acrodus falcifer*, C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil, p. 191, pl. xxiv. figs. 12–14, pl. xxv. figs. 15–21.

1887. *Acrodus* (?) *falcifer*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 104.

1887. *Acrodus falcifer*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 76, woodc. fig. 72.

Type. Imperfect skeleton, with dentition; Palæontological Museum, Munich.

Extremities of the principal lateral teeth rounded or acute; coronal surface with a longitudinal keel, and the superficial markings feebly reticulate.

The cuspidate anterior teeth are well seen in the type specimen, though not distinctly indicated in the published figure.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Bavaria.

38004. Plaster cast of type specimen, the original from Solenhofen. *Purchased*, 1864.

37014. Imperfect portions of the skull and other cartilages, with the vertebral column and broken dorsal fin-spines of a smaller fish about 0·29 in length; Solenhofen. The specimen is referred to *Acrodus* by C. Hasse, Neues Jahrb. 1883, vol. ii. p. 66. *Häberlein Coll.*

The following dorsal fin-spines, from the Kimmeridge Clay of Weymouth, probably pertain either to this or an allied species:—

43287, 43567. Two short broad spines, the exserted portion of the largest, when perfect, measuring about 0·025 in length. *Purchased*, 1871, 1872.

41878. Much smaller narrower spine. *Purchased*, 1869.

Cestracion sulcatus, sp. nov.

1843. *Strophodus sulcatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 176 (name only).

Type. Detached teeth, shown, of the natural size, in Pl. XIII. figs. 11, 12.

An imperfectly known species, the coronal contour of the principal teeth gently rounded, with angular or abrupt extremities; superficial reticulations very coarse, longitudinal keel generally indistinct, sometimes with a furrow on one side.

Form. & Loc. Cenomanian: Kent.

25858. Type specimens, figured, of the natural size, in Pl. XIII. figs. 11, 12; Upper Greensand, Maidstone. *Dixon Coll.*

39217. Two teeth, one relatively narrow and tapering at each extremity; Maidstone. *Bowerbank Coll.*

P. 2125. Two teeth named "*Strophodus sulcatus*," in Agassiz's handwriting; Maidstone. *Egerton Coll.*

P. 2664. Imperfect abraded tooth; Maidstone. *Enniskillen Coll.*

Cestracion canaliculatus, Egerton.

1850. *Cestracion canaliculatus*, Sir P. Egerton, in Dixon's Foss. Suss. p. 365, pl. xxxii.* fig. 8.
1850. *Acrodus cretaceus*, F. Dixon, *op. cit.* p. 364, pl. xxx. fig. 13.
1853. *Cestracion canaliculatus*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. ix. p. 281.
1872. *Drepanephorus canaliculatus*, Sir P. Egerton, Figs. & Descrips. Brit. Organic Remains (Mem. Geol. Surv.), dec. xiii. pl. ix.
1883. *Cestracion canaliculatus*, C. Hasse, Neues Jahrb. vol. ii. p. 66.
1887. *Drepanephorus canaliculatus*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 105.
1888. *Drepanephorus canaliculatus*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 290.

Type. Associated teeth.

Anterior dorsal fin-spine placed approximately over the twenty-fifth vertebra. Extremities of the principal lateral teeth rounded, and the longitudinal coronal keel in these raised mesially into a low rounded eminence; root pierced by a large oblique perforation.

Form. & Loc. Senonian: S.E. England.

49735. The right pterygo-quadrate and mandibular cartilages, with the anterior extremity of the left mandibular, preserved in the two halves of a small block of chalk; Upper Chalk, Guildford, Surrey. Though much crushed and broken, the pterygo-quadrate has the appearance of being notably longer than the mandibular. A few of the anterior teeth are displayed, and two are shown, of three times the natural size, from the posterior and anterior aspect respectively, in Pl. XI. figs. 24, 25; each has one pair of broad lateral denticles. Some of the principal lateral teeth of the upper jaw also occur in position. Those of the largest series (Pl. XI. fig. 26) measure 0·007 in length, and those of the series immediately behind (Pl. XI. fig. 26) 0·005;

the teeth of the series next to the largest in front are also about equal in size to the latter, and then follows a still narrower row, the teeth (Pl. XI. fig. 26) measuring 0·003 in length. A few displaced teeth, with an irregular ornamentation, are situated near the anterior extremity of the left mandibular ramus, and one is shown, of twice the natural size, in Pl. XI. fig. 27. *Capron Coll.*

49771. Imperfect remains of a small head preserved in the two halves of a block of chalk; Upper Chalk, Southeram Pit, Lewes, Sussex. *Capron Coll.*

39060. Fragments of cartilage with three teeth; (?) Kent. *Bowerbank Coll.*

P. 1293. Fragments of cartilage and about three teeth; Bromley, Kent. *Egerton Coll.*

49734. Portion of a vertebral column, with two dorsal fin-spines and remains of cartilage and shagreen, ascribed to this species by Sir Philip Egerton, Mem. Geol. Surv. *loc. cit.* pl. ix. fig. 2; Upper Chalk, Glynde, near Lewes. An anterior tooth of *C. canaliculatus* is artificially attached to the specimen, and may have been found associated. The first dorsal fin-spine is broken, but restored in Egerton's figure, and is not so much curved as in the fossil in the Willett Collection, Brighton. *Capron Coll.*

Cestracion rugosus (Agassiz).

1839. *Acrodus rugosus*, L. Agassiz, Poiss. Foss. vol. iii. p. 148, pl. xxii. figs. 28, 29.
1887. *Drepanophorus*, A. S. Woodward, Geol. Mag. [3] vol. iv. p. 103.
1888. *Drepanophorus*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 290.

Type. Detached tooth: Palæontological Museum, Munich.

A larger species than the foregoing, the principal teeth moderately elevated mesially, and the extremities sometimes narrowed, but either abruptly truncated or pointed.

Form. & Loc. Senonian: S.E. England. Danian: Holland.

4166. Nearly perfect tooth, shown, of the natural size, in Pl. XI. fig. 29; Lewes, Sussex. *Mantell Coll.*

P. 323. A smaller narrower tooth; Charing, Kent. *Harris Coll.*

Undetermined species of *Cestracion* are also indicated by the following teeth:—

47293 a. A very small tooth, and another shown of the natural size in Pl. XI. fig. 28; Gault, Folkestone. *Gardner Coll.*

28718. Two comparatively narrow teeth much raised mesially; Danian Beds, Ciply, near Mons, Belgium. *Purchased*, 1853.

P. 5836. Small tooth; Ciply. *Presented by Mons. A. Houzeau de Lehaie*, 1888.

43136. Narrow tooth, 0·012 in length, with a prominent longitudinal keel and obtusely angulated extremities; London Clay, Highgate Archway. *Wetherell Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Cestracion duponti, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. (1876), p. 17, pl. ii. figs. 1–3.—Bruxellian Eocene; Belgium.

Cestracion polydictyos: *Acrodus polydictyos*, A. E. Reuss, Verstein. böhm. Kreideform. pt. ii. (1846), p. 97, pl. xxi. figs. 1–8; C. E. Fischer, Allg. deutsch. Naturh. Zeitung, n. s. vol. ii. (1856), p. 139, pl. ii. figs. 29, 30; H. B. Geinitz, Palæontogr. vol. xx. pt. i. (1875), p. 296, pl. lxiv. fig. 23; A. Fritsch, Rept. u. Fische böhm. Kreideform. (1878), p. 16, woodc. fig. 39. *Drepanephorus*, A. S. Woodward, Geol. Mag. [3] vol. iv. (1887), p. 103.—Cenomanian and Turonian; Saxony and Bohemia.

The following dorsal fin-spines are referable in part to *Cestracion* and in part to *Synechodus*:—

47122. Small spine; Gault, Folkestone. *Gardner Coll.*

P. 3199. Two large imperfect specimens; Upper Greensand, Maidstone. *Enniskillen Coll.*

35160. Five fragments; Cambridge Greensand, Cambridge. *Purchased*, 1859.

P. 5888. Two fragments; Cambridge Greensand, Cambridge. *Egerton Coll.*

P. 405. Smaller spine; (?) Lower Chalk, Dover. *Presented by the Earl of Ducie*, 1881.

19830. Imperfect spine; Lower Chalk, Dover *Purchased*, 1846.

47921. Short broad spine: Chalk, Maidstone.
Presented by the Hon. Robert Marsham, 1877.

P. 325. Three fragments: Chalk, Hart Hill, Charing, Kent.
Harris Coll.

49736. Imperfect large spine, with four vertebræ; Upper Chalk, Guildford. *Capron Coll.*

4041, 4080, 4084–5, 4103. Five examples described and figured by Agassiz, Poiss. Foss. vol. iii. (1837), p. 62, pl. x. *b*. figs. 8, 10–14, under the name of *Spinax major*; Upper Chalk, Lewes. *Mantell Coll.*

P. 1294. Nearly complete arched spine; Chalk, Sussex.
Egerton Coll.

48949. Small narrow spine, incomplete; U. Chalk, Norwich.
Bayfield Coll.

48949 a. Narrow spine, not much curved, worn or broken at the extremity; Upper Chalk, Norwich. *Bayfield Coll.*

P. 4921. Large much-curved spine, associated with a series of thirty vertebræ; Chalk, Sussex. *Purchased*, 1885.

Similar dorsal fin-spines have also been described and figured from the Cretaceous of Saxony (H. B. Geinitz, Charact. Schicht. u. Petrefakt. Sachs. Kreidegeb., Nachtr. 1843, p. 5, pl. iv. fig. 4; also Palæontogr. vol. xx. pt. ii. p. 211, pl. xl. figs. 36–38); but the so-called *Spinax marginatus* and *S. rotundatus*, A. E. Reuss (Verstein. böhm. Kreideform. pt. i. 1845, p. 8, pl. iv. figs. 10, 11, 13, 14), from the Turonian of Bohemia, are Teleostean teeth.

The following imperfect series of vertebræ may also perhaps be referable to *Synechodus* or *Cestracion*:—

4110. Series of about forty much-broken vertebræ, referred to *Spinax major* by Agassiz, *tom. cit.* pl. xl. *a*. fig. 6; Chalk, Lewes.
Mantell Coll.

38114. Chain of small vertebræ, with traces of cartilage and shagreen; Lower Chalk, Dover. *Purchased*, 1864.

49079. Series of much larger broken vertebræ, with remains of the head, pectoral arch, and pelvic arch, with claspers; Lower Chalk, Dover. *Gardner Coll.*

P. 4326. Short chain of vertebræ; Lower Chalk, Kent.
Enniskillen Coll.

The following "genera" and "species" may possibly be founded upon the anterior teeth of undetermined Cestraciontidæ, but their systematic position is uncertain:—

Doratodus tricuspidatus, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9 (1861), p. 10, pl. i. figs. 28–37; H. Eck, Form. bunt. Sandst. u. Muschelk. Oberschlesien (1865), p. 61; and E. E. Schmid, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. i. pt. ii. (1874), p. 56.—Keuper, Germany.

Gomphodus agassizii, A. E. Reuss, Verstein. böhm. Kreideform. pt. ii. (1846), p. 99, pl. xxi. figs. 22–25; A. Fritsch, Rept. u. Fische böhm. Kreideform. (1878), p. 10, woodc. fig. 20.—Cenomanian; Bohemia.

The following specimens in the Collection are referable to the latter "genus":—

41702. Complete tooth; Chalk, Gravesend, Kent. *Toulmin Smith Coll.*

P. 334. Two teeth; Chalk, Charing, Kent. *Harris Coll.*

Family SCYLLIIDÆ.

Dorsal fins without spines, the first situated above or behind the pelvic fins. No nictitating membrane. Teeth small, several series being generally in function.

Genus **PALÆOSCYLLIUM,** Wagner.

[Gelehr. Anz. bay. Akad. Wiss. vol. xliv. 1857, p. 291.]

First dorsal fin above or partly behind the pelvics; origin of second dorsal in advance of the anal, which is small. Tail of moderate length. [Teeth unknown, but probably minute.]

As pointed out by Wagner, the arrangement of the fins in this genus is suggestive of *Ginglymostoma*: and Hasse describes[1] the vertebral column as indistinguishable from that of *Scyllium*.

Palæoscyllium formosum, Wagner.

1857. *Palæoscyllium formosum*, A. Wagner, Gelehr. Anz. bay. Akad. Wiss. vol. xliv. p. 291.

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[1] Natürl. Syst. Elasmobr., Besond. Theil, p. 252, pl. xxxiv. fig. 27.

1863. *Palæoscyllium formosum*, A. Wagner, Abh. k. bay. Akad. Wiss., math.-phys. Cl. vol. ix. p. 289, pl. v. fig. 2.
1882. *Scyllium catulus*, C. Hasse (*non* Linn.), Natürl. Syst. Elasmobr., Besond. Theil, p. 252, pl. xxxiv. fig. 27.
1887. *Palæoscyllium*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 79.

Type. Trunk of fish; Munich Museum.

The type species attaining a length of about 0·4. Pelvic fins completely beneath the first dorsal: anal fin beneath the hinder portion of the second dorsal.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Bavaria.

Palæoscyllium minus, sp. nov.

Type. Nearly complete fish; British Museum.

Pectoral fins relatively large. Origin of pelvic fins in advance of the first dorsal: anal completely behind the second dorsal.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Bavaria.

P. 5541. Type specimen, figured, of two thirds the natural size, in Pl. XVI. fig. 4; Eichstädt. The fish is almost complete, though in some parts indistinctly preserved. The snout appears to be very obtuse, and the cranial cartilage, so far as observable, presents no features worthy of note. No teeth can be distinguished, and the cartilages of the jaws are crushed and fragmentary. The vertebral column is almost complete and consists of about 100 centra. Of the paired fins, the pectorals appear to have been very large, the length equalling that of the head; and the pelvic fins also attain to considerable proportions, one being well shown and exhibiting several stout cartilaginous rays. When pressed to the side of the trunk the pectorals extend to the base of the pelvic fins; and opposite a point immediately behind the origin of the latter the first dorsal arises. The dorsal fins are nearly equal in size, triangular in form, and separated by an interval only half as long as the base-line of either. The anal, so far as preserved, is extremely small, and placed completely behind the second dorsal; and the caudal fin immediately follows, with an indication of an inferiorly notched extremity. The body is covered with fine dense shagreen, the granules being mostly quadrate, with rounded angles, but sometimes distinctly spinous. *By exchange*, 1888.

Genus **SCYLLIUM**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 124.]

Syn. *Thyellina*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 378.
Scylliodus, L. Agassiz, *tom. cit.* p. 377 (in part).

First dorsal fin above or behind the pelvics; origin of anal always in advance of that of the second dorsal. Upper edge of the caudal fin not serrated. Teeth small, delicate, with a middle longer cusp, and generally one or two small lateral cusps, arranged in numerous series.

Scyllium angustum (Agassiz).

1843. *Thyellina angusta*, L. Agassiz, Poiss. Foss. vol. iii. p. 378, pl. xxxix. fig. 3.
1873. *Thyellina angusta*, W. von der Marck, Palæontogr. vol. xxii. p. 64, pl. ii. figs. 6, 7.
1882. *Scyllium catulus*, C. Hasse (*non* Linn.), Natürl. Syst. Elasmobr., Besond. Theil, p. 252.

Type. Fish, wanting head; Woodwardian Museum, Cambridge, and Munich Museum.

Pectoral fins large; pelvic fins truncated behind, slightly in advance of the opposing first dorsal. Second dorsal fin larger than the first dorsal, and also much larger than the anal, to which it is almost completely opposed. [Teeth unknown.]

This species, the type of *Thyellina*, is referred to *Scyllium* by Hasse and identified by him with *S. catulus* (=*S. canicula*); the fossil form, however, is readily distinguished specifically by the character of the fins.

Form. & Loc. Upper Cretaceous (Senonian): Westphalia.

Scyllium antiquum (Agassiz).

1843. *Scylliodus antiquus*, L. Agassiz, Poiss. Foss. vol. iii. p. 378, pl. xxxviii. figs. 1, 3 (*non* fig. 2).

Type. Imperfect head, &c.; British Museum.

Teeth with a very slender coronal eminence, and a single pair of widely separated short lateral denticles. Posterior coronal face in most of the teeth, and both faces of the crown in those placed at the back of the jaw, vertically striated.

Form. & Loc. Turonian: Kent.

P. 472, P. 5889. Type specimen, preserved in counterpart, exhibiting remains of the head, with a few scattered teeth and imperfect vertebræ; Lower Chalk, Burham, Kent. A few

smooth, leaf-shaped shagreen-granules are to be observed; but the structures shown in fig. 4 of Agassiz's plate are the calcified tesseræ of the endoskeletal cartilage.

Egerton and Enniskillen Colls.

Scyllium dubium, sp. nov.

Type. Group of teeth; British Museum (Pl. XVI. figs. 7, 8).

Teeth with an extremely slender coronal eminence, having two pairs of lateral denticles, the inner very long, slender, and curved, the outer smaller and at a lower level.

Form. & Loc. Turonian: Kent.

47288. The type specimen, being a group of teeth associated with remains of cartilage and a vertebral centrum; Lower Chalk, Dover. Two of the teeth are shown, enlarged eight times, in Pl. XVI. figs. 7, 8. *Gardner Coll.*

Scyllium elongatum (Davis).

1887. *Thyellina elongata*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 473, pl. xiv. figs. 2, 3.

Type. Nearly complete fish; Edinburgh Museum.

Teeth slender, erect, with one pair of lateral denticles: those of the lower jaw much larger and fewer than those of the upper. Trunk very slender and elongated. Pelvic fins immediately in advance of the first dorsal. Second dorsal much larger than the first; [anal unknown].

The known specimens do not attain a greater length than 0·25.

Form. & Loc. Upper Cretaceous (Senonian): Sahel Alma, Mount Lebanon, Syria.

49521. An imperfectly preserved fish, 0·22 in length. The head and pectoral fins are well shown in outline: also a few teeth of both jaws in position (Pl. XVI. fig. 5), displaying the characters noted in the diagnosis. *Purchased*, 1878.

P. 4775. A nearly complete fish, vertically crushed and apparently much flattened. The pectoral, pelvic, and caudal fins are exhibited: and indications of slender conical teeth may be observed in the mouth. *Purchased*, 1884.

48104. Anterior portion of a more typical specimen. *Purchased*, 1887.

49472. Imperfect young individual, showing the head, pectoral, and pelvic fins. *Purchased*, 1878.

Scyllium curtirostre (Davis).

1887. *Thyellina curtirostris*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 475, pl. xv. fig. 1.

Type. Incomplete fish; British Museum.

Teeth of lower jaw broad, the coronal cusp much inclined posteriorly, with indistinct lateral denticles, or destitute of these. Pectoral fins of moderate size; [other fins imperfectly known].

The known specimens do not attain a greater length than 0·4.

Form. & Loc. Upper Cretaceous (Senonian): Sahel Alma, Mount Lebanon, Syria.

P. 4022. Type specimen, described and figured by J. W. Davis, *loc. cit.* *Purchased*, 1883.

49476. A less perfect specimen, probably of this species, 0·338 in length. *Purchased*, 1878.

49471. Imperfect anterior portion of trunk, with pectoral fins. *Purchased*, 1878.

Scyllium (?) tumidens, sp. nov.

Type. Anterior portion of fish; British Museum.

Teeth apparently similar in both jaws, each with an erect principal cone and a single pair of large, slightly divergent lateral denticles; base of principal cone and the lateral denticles tumid and marked with delicate vertical striæ.

Form. & Loc. Upper Cretaceous (Senonian): Sahel Alma, Mount Lebanon, Syria.

P. 4777. Type specimen, displaying the head from the inferior aspect, traces of about thirty anterior vertebræ, the pectoral arch, and the right pectoral fin. The snout is very obtuse, and the head measures 0·047 in length. The teeth are numerous and relatively small, displaying the characters already noted in the specific diagnosis, and one is shown, of six times the natural size, in Pl. XVI. fig. 6. The pectoral fin is acutely triangular, with a short base of insertion, and slender basal cartilaginous rays. *Purchased*, 1884.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Scyllium acre, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 171, pl. iii. fig. 27.—Molasse; Baltringen, Würtemberg.

Scyllium distans, J. Probst, *tom. cit.* p. 170, pl. iii. figs. 23–26.—**Molasse; Baltringen.**

Scyllium guttatum, J. Probst, *tom. cit.* p. 171, pl. iii. figs. 28, 29.—**Molasse; Baltringen.**

Scyllium d'achiardii, R. Lawley, Nuovi Studi Pesci etc. Colline **Toscane (1876), p. 36.—Pliocene; Tuscany.**

Scyllium hauchecorni, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 93, pl. v. fig. 5.—Upper Eocene (Zone A_1); Samland, Prussia.

Scyllium paulucci, R. Lawley, *op. cit.* p. 36.—Pliocene; Tuscany.

Other teeth of *Scyllium*, from the Miocene of Hérault, are noticed by P. Gervais, Zool. et Pal. Gén. (1867–69), p. 237, pl. xlvii. fig. 8. A vertebra from the Molasse of Baltringen is also assigned to *Scyllium* by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 248, pl. xxxiii. fig. 10; while the same author describes vertebræ of the type of *Scyllium catulus* from the Oligocene of Palmnicken (Palæontogr. vol. xxxi. 1884, p. 7, pl. ii. fig. 12), and of *Scyllium edwardsi* from the Upper Chalk of Dorking (*ibid.* p. 7, pl. ii. figs. 10, 11). See also F. Noetling, *loc. cit.* p. 96, pl. viii. fig. 10.

Of very doubtful position are the small teeth from the Plänerkalk of Bohemia and Saxony, described under the following names: — *Scyllium crassicostum*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. 1845, p. 4, pl. ii. figs. 21, 22, pl. xii. fig. 11 (*Hybodus appendiculatus*, A. E. Reuss, Geogn. Skizze Böhmen, vol. ii. 1844, p. 219.—*Scylliodus crassicostus*, H. B. Geinitz, Palæontogr. vol. xx. pt. i. p. 295, pl. lxv. fig. 8, and A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 11, fig. 22.—*Hybodus serratus*, C. E. Fischer, Allg. deutsch. Naturh. Zeit. n. s. vol. ii. 1856, p. 140, pl. ii. fig. 36); *Scyllium humboldti* A. E. Reuss, *op. cit.* pt. i. p. 4, pl. iv. figs. 4–8 (*Scylliodus humboldti*, A. Fritsch, *op. cit.* p. 11, fig. 21).

The preoccupied term *Palæoscyllium* has been employed by W. von der Marck for a fossil dog-fish from the Senonian of Arenfeld, Westphalia, the generic distinctness of which from *Scyllium* yet remains to be demonstrated. The species is named *P. dechani*[1].

It is also not improbable that the teeth described under the following names belong to *Scyllium* or an allied genus:—

Trigonodus minutus, T. C. Winkler, Archiv. Mus. Teyler, vol. v. (1880), p. 81, woodc. figs. 4, 5.—Upper Eocene; Limbourg, Belgium.

[1] Verh. naturh. Verein. preuss. Rheinl. u. Westphal., Jahrg. xvii. (1860), Correspondenzbl. p. 47 (name only); Palæontographica, vol. xi. (1863), p. 67, pl. viii. figs. 6–9, *ibid.* vol. xv. (1868), p. 289; *ibid.* vol. xxii. (1873) p. 65 pl. ii. fig. 9.

Trigonodus secundus, T. C. Winkler, *loc. cit.* vol. iv. (1876), p. 20, pl. ii. figs. 4, 5.—Bruxellian Eocene; Brussels.

Trigonodus tertius, T. C. Winkler, *loc. cit.* vol. iv. (1876), p. 21, pl. ii. figs. 6, 7.—Bruxellian Eocene; Brussels.

Lamna triplex, F. A. Quenstedt, Handb. Petrefakt. 3rd edit. (1882), p. 268, pl. xx. figs. 26.—"Feuerstein; Märkische Geschiebe."

Otodus tricuspis, L. Agassiz, Pois. Foss. vol. iii. (1843), p. 273, pl. xxxvi. fig. 28.—Lower Miocene; Wilhelmshöhe, near Cassel.

Orthodon condamyi, H. Coquand, Descr. Géol. Dépt. Charente, vol. ii. (1860), p. 126.—Upper Cretaceous; Charente, France.

Genus **PRISTIURUS,** Bonaparte.

[Faun. Ital. vol. iii. 1841, art. 131.]

Dorsal and anal fins as in *Scyllium*. A series of small flat spines on each side of the upper edge of the caudal fin. Snout much elongated. Teeth small, tricuspid.

Pristiurus hassei, sp. nov.

1862. *Notidanus* (young), A. Wagner, Abh. k.bay. Akad. Wiss., math.-phys. Cl. vol. ix. p. 295.

1882. *Pristiurus*, C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil, p. 255, pl. xxxv. figs. 45, 46.

Type. Nearly complete fish; Palæontological Museum, Munich.

A very small species, distinguished from the existing *P. melanostomus* by the relatively greater size of the tail. The second dorsal fin is situated above the hinder part of the anal; and the length of the tail behind the second dorsal is equal to that of the trunk in advance of this fin.

Form. & Loc. Lower Kimmeridgian (Lithographic Stone): Bavaria.

38003. Plaster cast of type specimen, figured, without specific name, by C. Hasse, *op. cit.*; Eichstädt. The snout is indicated as being very obtuse, and, if confirmed, this feature will necessitate a slight modification in the accepted definition of the genus. *Purchased*, 1864.

Genus **MESITEIA,** Kramberger.

[Rad jugoslav. Akad. vol. lxxii. 1885, p. 53.]

First dorsal fin above or behind the pelvics; anal fin long. Tail

excessively elongated, without dermal scutes or spines; snout produced. Shagreen absent or very delicate; lateral line supported by a series of calcified incomplete rings. Teeth minute, numerous, tricuspid.

Mesiteia sahel-alm (Pictet & Humbert).

1866. *Scyllium sahel-almæ*, Pictet & Humbert, Nouv. Rech. Poiss. Foss. Mt. Liban, p. 111, pl. xviii. figs. 2–4.

1887. *Scyllium sahel-almæ*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 476, pl. xv. fig. 3.

1888. "*Scyllium*" *sahel-almæ*, A. S. Woodward, Proc. Zool. Soc. p. 126.

Type. Fish, wanting the greater portion of the caudal region; Geneva Museum.

A species attaining a total length of about 0·19. Origin of the first dorsal fin immediately behind the pelvics, the latter much larger than the pectoral fins. Length of the caudal region beyond the pelvic fins about four times as great as the space between the pectorals and pelvics.

In placing this species in the genus *Scyllium*, Pictet and Humbert employed the term in a very wide sense. They recognized resemblances to *Pristiurus*, but the discovery of the tail now determines the generic distinctness of the fish.

Form & Loc. Upper Cretaceous (Senonian): Sahel Alma, Mount Lebanon, Syria.

P. 4778, 48107. A nearly complete fish, shown, of the natural size, in Pl. XVI. fig. 1, and partially described by J. W. Davis, *loc. cit.* The counterpart of the anterior half only is preserved. There are indications of the production of the cranium at least 0·017 in advance of the jaws (*m.*), and the anterior fontanelle (*f.*) is well shown. Each mandibular ramus measures about 0·01 in length, and numerous minute cuspidate teeth are displayed. Remains of the branchial arches ("branchiostegal rays," *Davis*) are distinct upon each side. The vertebræ are longer than deep, much constricted, and evidently asterospondylic in structure; there are slender ribs, and in the caudal region the neural and hæmal arches are well displayed. The hæmal spines are long and narrow, each expanded distally; while the neural spines are comparatively small, alternating with the intercalary cartilages. The precise characters of the pectoral arch (*pct.*) cannot be determined; and the only noteworthy feature in the pectoral fins is the great length of the metapterygium, which bears not

less than ten cartilaginous rays. The pelvic arch and fins (*plv.*) are more satisfactorily preserved, and remarkable on account of their relatively large size; there is a distinct prepubic process (*p. pb.*), and the basal pterygium of the fin is much elongated, bearing not less than sixteen robust cartilaginous rays. The first dorsal fin (*d'*) is only seen upon the counterpart of the fossil, but is introduced into the figure for completeness. It is situated immediately behind the pelvics, and still further posteriorly are a few rays of another small median fin (*d²*) above the neural arches, evidently to be interpreted as the second dorsal. No traces of the anal fin can be discerned. A few impressions of the muscles occur in the abdominal region; but there is no evidence of shagreen upon any portion of the fossil, and the only external dermal structures are some of the series of calcified rings supporting the groove of the lateral line. A portion of the counterpart is enlarged four times to show the latter, in Pl. XVI. fig. 3 (*l.l.*), the structures having already been described by the present writer (Proc. Zool. Soc. 1888, p. 126).

Purchased, 1878, 1884.

46506, 49515. Two imperfect specimens; a tooth of the first shown, of twelve times the natural size, in Pl. XVI. fig. 2.

Purchased, 1875, 1878.

Mesiteia emiliæ, Kramberger.

1885. *Mesiteia emiliæ*, D. Gorganovic Kramberger, Rad jugoslav. Akad. vol. lxxii. p. 54, pl. iii. fig. 2 [1].

Type. Nearly complete skeleton; Geological Museum, University of Agram, Croatia.

The type species, somewhat larger than *M. sahel-almæ*, and differing in the relatively larger size and more posterior situation of the dorsal fins.

Form. & Loc. Middle Eocene: Monte Bolca, near Verona.

Genus **CHILOSCYLLIUM,** Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 17.]

First dorsal fin above or behind the pelvic fins; the anal fin far behind the second dorsal, and very close to the caudal. Teeth small, triangular, with or without lateral cusps.

[1] A German abstract of this memoir appeared in 1886.

Chiloscyllium fossile, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 171, pl. iii. fig. 30.—Molasse; Baltringen, Würtemberg.

Genus **CROSSORHINUS**, Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 21.]

First dorsal fin behind the pelvic fins, and the second in advance of the anal, which is very close to the caudal. Tail short. Head broad and flat, with lateral appendages of skin; mouth wide, nearly terminal; eyes small; the spiracle a wide oblique slit, behind and below the eye. Teeth comparatively few and large, the middle portion of the anterior coronal face extending downwards as a process over the root. Anterior teeth long, slender, subulate; lateral teeth less elevated, tricuspid.

Some of the teeth are scarcely distinguishable from those of *Squatina*, and no fossil examples have hitherto been recorded.

A vertebra from the "Gault" (? Cambridge Greensand) of Cambridge is supposed to belong to *Crossorhinus* by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 200, pl. xxv. figs. 7–10.

Genus **CANTIOSCYLLIUM**, nov.

Syn. *Scylliodus*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 377 (in part).

Teeth robust, with a broad depressed root, flattened and scarcely divided into two radicles. Dental crown consisting of a single elevated principal cone, with one or two pairs of small lateral cones; the anterior coronal face produced downwards and forwards mesially. Vertebræ large, deep and short in the abdominal region.

The character of the dentition suggests affinities with *Gingly-mostoma*. Before any teeth had been exposed, however, the type specimen of the only known species had been theoretically associated with the remains of a distinct fish (*Scyllium antiquum*, p. 340), to form a "genus" named *Scylliodus*.

Cantioscyllium decipiens, sp. nov.

Type. Head and anterior portion of trunk; British Museum. Teeth striated.

Form. & Loc. Turonian: Kent.

P. 5890. The type specimen, consisting of the imperfect mandibular and hyoid arches, pectoral arch, and the anterior portion of the vertebral column, figured by Agassiz, *tom. cit.* pl. xxxviii. fig. 2 (*Scylliodus antiquus*): Lower Chalk, Burham, Kent. Several teeth have been exposed by the

removal of matrix since the publication of the original figure and description; and these exhibit the characters noted in the foregoing generic and specific diagnoses.

Enniskillen Coll.

Genus **GINGLYMOSTOMA,** Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 22.]

Syn. *Nebrius*, E. Rüppell, Neue Wirbelth. Abyssinien, Fische, 1835, p. 62.

Plicodus, T. C. Winkler, Archiv. Mus. Teyler, vol. iii. 1874, p. 301.

Acrodobatis, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. 1877, p. 250.

First dorsal fin above or partly behind the pelvics; origin of second dorsal in advance of the anal. Teeth robust, with a broad depressed root, flattened and not divided into two radicles; anterior face of the crown much larger than the posterior, produced downwards and forwards mesially, the trenchant coronal border more or less coarsely denticulated.

Ginglymostoma serra (Leidy).

1877. *Acrodobatis serra*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. p. 250, pl. xxxiv. figs. 10–13.

(?) 1877. *Acrodobatis obliquus*, J. Leidy, *tom. cit.* p. 250, pl. xxxiv. fig. 14.

Type. Detached teeth.

Median cusp of dental crown narrow, prominent; lateral serrations relatively small and numerous (about 7–9).

Form. & Loc. Eocene: South Carolina, Alabama, and (?) New Jersey, U.S.A.

P. 1216. Two teeth, one shown of the natural size in Pl. XVI. fig. 9; Clarke's Co., Alabama. *Egerton Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Ginglymostoma minutum, W. Dames, Neues Jahrb. 1888, vol. ii. Referat. p. 323. *Hybodus minutus*, H. Forir, Ann. Soc. Géol. Belg. vol. xiv. (1887), p. 35, pl. ii. figs. 2, 3.—Danian; Maastricht, Belgium.

Ginglymostoma thielense, F. Noetling, Sitzb. Ges. naturf. Fr. Berlin, 1886, p. 14, figs. 2, 3. *Plicodus thielensis*, T. C. Winkler, Archiv. Mus. Teyler, vol. iii. (1874), p. 301, pl. vii. fig. 5; *ibid.* vol. iv. (1876), p. 20.—Bruxellian Eocene; Belgium.

Family LAMNIDÆ.

Dorsal fins without spines, the first situated opposite to the space between the pectoral and pelvic fins. No nictitating membrane. Gill-openings generally wide; spiracles minute or absent. Teeth solid when completely formed, pointed, and in most genera relatively large.

Owing to the considerable variation in the form of the teeth in different parts of the mouth, the satisfactory determination of the extinct species of the various genera of Lamnidæ is almost impossible. The following arrangement is thus in a great measure provisional.

Genus **ORTHACODUS,** nomen nov.

Syn. *Sphenodus*, L. Agassiz (non *Sphenodon*, Gray, 1831, nec *Sphenodon*, Lund, 1839), Poiss. Foss. vol. iii. 1843, p. 288.

An extinct genus, known only by detached teeth, and provisionally assigned to the family of Lamnidæ. Each tooth consists of a slender, erect, more or less compressed crown, placed upon the centre of the anterior margin of a horizontally expanded root. The latter is not forked or divided, and resembles the root of the tooth in *Cladodus* and certain species assigned to *Hybodus*.

Orthacodus longidens (Agassiz).

1843. *Lamna (Sphenodus) longidens*, L. Agassiz, Poiss. Foss. vol. iii. p. 298, pl. xxxvii. figs. 24–29.

1846. *Squalus phillipsii*, C. Rouillier, Bull. Soc. Imp. Nat. Moscou, pt. ii. pl. B. fig. 6. (Name given, *loc. cit.* 1847, pt. i. p. 372.)

1852. *Oxyrhina longidens*, F. A. Quenstedt, Handb. Petrefakt. p. 172, pl. xiii. fig. 11.

1852. *Oxyrhina macer*, F. A. Quenstedt, *op. cit.* p. 172, pl. xiii. fig. 18.

1852. *Oxyrhina ornati*, F. A. Quenstedt, *op. cit.* p. 173, pl. xiii. fig. 13.

1858. *Oxyrhina ornati*, F. A. Quenstedt, Der Jura, p. 467, pl. lxiii. fig. 5.

(?) 1858. *Sphenodus*, F. A. Quenstedt, *op. cit.* p. 662, pl. lxxxi. fig. 36.

1858. *Oxyrhina macer*, F. A. Quenstedt, *op. cit.* p. 783, pl. xcvi. figs. 45, 46.

1860. *Sphenodus macer*, H. Trautschold, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 356, pl. viii. figs. 23, 24.

1861. *Sphenodus macer*, H. Trautschold, Zeitschr. deutsch. geol. Gesell. vol. xiii. p. 433.

1861. *Sphenodus longidens*, H. Trautschold, *tom. cit.* p. 433.

1875. *Sphenodus macer*, K. Fricke, Palæontogr. vol. xxii. p. 394, pl. xxi. fig. 21.

1876. *Sphenodus longidens*, E. Favre, Foss. Terr. Oxford. Alpes Tribourg. (Mém. Soc. Pal. Suisse, vol. iii.), pl. ii. fig. 2.

Type. Detached dental crowns: Munich Museum (in part).

The type species, of moderate size. Dental crown narrow, attaining a maximum height of about 0·03, and scarcely sigmoidally curved; inner coronal face gently convex, outer face flat or slightly convex; cutting-edges very prominent.

O. macer was only distinguished by Quenstedt on account of its occurring at a somewhat higher horizon than the typical teeth.

Form. & Loc. Oxfordian: Bavaria and Würtemberg. Corallian: Würtemberg and Hanover. Upper Jurassic: Government of Moscow, Russia.

P. 1254–5. Typical dental crown, and small example; Oxfordian, Rabenstein, Bavaria. *Egerton Coll.*

P. 5753. Three small dental crowns; Rabenstein. *Enniskillen Coll.*

P. 1256. Small dental crown; Oxfordian, Streitberg, Franconia. *Egerton Coll.*

22489, 22503, 22658. Eight dental crowns; Corallian, Schnaitheim, Würtemberg. *Purchased*, 1848.

P. 2370. Dental crown; Schnaitheim. *Enniskillen Coll.*

The following species are also distinguished, but there are no examples in the Collection:—

Orthacodus impressus, K. A. von Zittel, Fauna Aelt. Cephalopodenführ. Tithonbild. (Suppl. to Palæontogr., 1870), p. 25, pl. i. figs. 3, 4 (*Sphenodus*).—Tithonian; Southern Alps.

Orthacodus nitidus, A. Wagner, Abh. königl. bay. Akad. Wiss., math.-phys. Cl. vol. ix. (1863), p. 290, pl. iv. fig. 4 (*Sphenodus*).—Lithographic Stone; Bavaria.

Orthacodus tithonius, G. G. Gemmellaro, Studi Paleont. Fauna Calc. a *Terebratula janitor* N. Sicilia, pt. i. (1868–76), p. 8, pl. ii. figs. 32–41 (*Sphenodus*).—Upper Jurassic; Sicily.

Orthacodus virgai, G. G. Gemmellaro, *op. cit.* pt. i. p. 8, pl. ii. figs. 42–47 (*Sphenodus*).—Upper Jurassic; Sicily.

To this genus also Quenstedt (Handb. Petrefakt. 3rd edit. 1882, p. 271) refers the Liassic tooth named *Lamna liassica*, U. Schönbach (Neues Jahrb. 1863, p. 166).

Somewhat doubtfully placed in this genus is *Sphenodus sabaudianus*, Pictet (Foss. Terr. Néocom. Voirons, pt. iii. (1858), p. 50, pl. vii. figs. 9–11), from the Neocomian of Voirons, apparently figured under the name of *S. valentinus* by P. Gervais (Zool. et Pal. Franç., 2nd. edit. p. 524, pl. lxxvi. figs. 9, 10); and *Lamna* (*Sphenodus*) *plana*, Agassiz (Poiss. Foss. vol. iii. 1843, p. 298, pl. xxxvii. figs. 30–32), from the Cenomanian of Switzerland, is probably a true *Lamna*.

Genus **SCAPANORHYNCHUS,** nov.

Syn. *Rhinognathus*, J. W. Davis (non *Rhinognathus*, Fairmaire, 1873), Trans. Roy. Dublin Soc. [2] vol. iii. 1887, p. 480.

Body slender, snout much elongated. Second dorsal fin small, placed immediately above a long anal. Caudal fin much elongated, inferiorly notched near the extremity. Teeth with a long slender principal cusp, and mostly with a pair of minute lateral cusps.

This genus is very imperfectly defined by J. W. Davis (*loc. cit.*) under the preoccupied name of *Rhinognathus*, and erroneously referred to the Spinacidæ.

Scapanorhynchus lewisii (Davis).

1887. *Rhinognathus lewisii*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iii. p. 480, pl. xiv. fig. 4.

Type. Imperfect fish; Edinburgh Museum.

Length of snout in advance of the mouth not more than twice as great as the width of the head at this position. Extent of the caudal fin nearly equal to the entire length of the trunk in advance of its origin. Teeth with the inner face of the coronal cusp prominently striated.

Form. & Loc. Upper Cretaceous (Senonian): Sahel Alma, Mount Lebanon, Syria.

48099. Imperfect remains of the head and a fragment of the anterior portion of the trunk, with indications of the pectoral arch and fins. A number of teeth are well shown, one being drawn, four times the natural size, in Pl. XVII. fig. 6. *Purchased*, 1877.

49473. Crushed snout and head, with numerous teeth in position, a few anterior vertebræ, and the left pectoral fin. Two of the anterior teeth are shown, of three times the natural size, from the inner and outer aspects, in Pl. XVII. figs. 4, 5. *Purchased*, 1878.

49474. Head and branchial region, shown, of two thirds the natural size, in Pl. XVII. fig. 2, extending somewhat further backwards and displaying the imperfect pectoral fins. The intertrabecular rostral cartilage is prominent: a few characteristic teeth are seen; and there are distinct remains of some of the branchial arches and gill-clefts.

Purchased, 1878.

49475. Imperfect head, with the snout nearly complete, and crushed remains of the anterior portion of the trunk, with the left pectoral fin. A few teeth are exhibited, including one of the hindmost, shown, of four times the natural size, in Pl. XVII. fig. 7. *Purchased*, 1878.

49551. A less perfect specimen, exhibiting several teeth. The lateral aspect of the crown of an anterior tooth is shown, of three times the natural size, in Pl. XVII. fig. 3. The posterior face of the crown in the lateral teeth appears to be smooth. *Purchased*, 1878.

P. 4020. A nearly complete trunk, imperfect in the anterior dorsal region, shown, of two thirds the natural size, in Pl. XVII. fig. 1. The body is covered with a fine dense shagreen, and this, in addition to the fossilization of the muscular tissues, renders the outline distinct; the fins, however, seem to have been destitute of shagreen towards all the free margins, except the anterior one, and their exact proportions are thus not determinable. Most of the vertebral centra are much broken, but their asterospondylic character is evident, and in the abdominal region they are deeper than long; in the caudal region their size very gradually diminishes towards the posterior extremity, and above the inferior lobe of the caudal fin the hæmal arches are distinct. The small second dorsal fin (d^2.) is completely opposed to the anterior half of the much elongated anal (*an.*). The pelvic fins (*plv.*) are large, and arise about halfway between the pectorals (*pct.*) and the anal; and at the base of each of these fins a numerous series of delicate cartilages is distinguishable. The long caudal fin (*c.*) is well preserved, and shows very distinctly the single inferior notch near its hinder extremity.

Purchased, 1883.

48100–03. Four imperfect examples of the trunk. *Purchased*, 1877.

Scapanorhynchus elongatus, sp. nov.

Type. Head and anterior portion of trunk, shown, of two thirds the natural size, in Pl. XVII. fig. 8.

An extremely elongated species. Length of snout in advance of the mouth not less than three times as great as the width of the head at this position. Extent of the caudal fin not equalling more than one half the entire length of the trunk in advance of its origin. Teeth with the posterior face of the coronal cusp prominently striated, scarcely differing from the teeth of *S. lewisii*.

Form. & Loc. Upper Cretaceous (Senonian); Sahel Alma, Mount Lebanon, Syria.

P. 4774. Type specimen, mostly shown, of two thirds the natural size, in Pl. XVII. fig. 8. The outline of the slender snout is well exhibited; the mouth is large; the vertebral centra are much elongated; and the body is covered with fine dense shagreen. Several teeth of both jaws are preserved, all being slender, but those placed near the symphysis possess especially high and narrow crowns.

Purchased, 1884.

P. 4773. An imperfectly preserved fish, 0·645 in length, wanting all the fins except the caudal. An impression of the inner face of an anterior tooth shows marks of the characteristic striations; and the vertebræ are distinctly asterospondylic, most being longer than deep. The distance from the mouth to the beginning of the caudal fin is about 0·395; and the length of this fin is approximately 0·19.

Purchased, 1884.

Scapanorhynchus rhaphiodon (Agassiz)[1].

1843. *Lamna* (*Odontaspis*) *rhaphiodon*, L. Agassiz, Poiss. Foss. vol. iii. p. 296, pl. xxxvii. *a*. figs. 12–16 (*non* fig. 11).

1842. *Lamna* (*Odontaspis*) *rhaphiodon*, H. B. Geinitz, Charact. Schicht. u. Petrefakt. sächs.-böhm. Kreidegeb. pl. xvii. figs. 13, 14.

[1] To this species (see H. E. Sauvage, Bull. Soc. Géol. France [2] vol. xvi. 1880, p. 457, provisionally assigned *Lamna* sp. ?, H. Coquand, Descript. Géol. &c. Départ. Charente, vol. i. 1860, p. 85). The descriptions seem, if correct, render the determination doubtful.

Very slender teeth, some from Upper Cretaceous of New Jersey, Texas, Alabama, Kansas, and Mississippi, U.S.A., are referable to the genus *Lamna* (Cuvier), F. Roemer, Kreidebild. von Texas (1852) p. 20, pl. i. fig. 7; see also J. Leidy, Rep. Geol. Surv. Texas, vol. i. pt. 1 (1873), p. 394, pl. xviii. figs. 46–50, and E. D. Cope, *ibid.* vol. ii. (1875) p. 296.

1845. *Odontaspis rhaphiodon*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 7, pl. vii. fig. 15, pl. xii. fig. 3 (*non* pl. iii. figs. 34–36).

1845. *Lamna plicatella*, A. E. Reuss, *op. cit.* pt. i. p. 7, pl. iii. figs. 37–44.

1850. *Enchodus halocyon*, H. B. Geinitz (*non* Agassiz), Charact. Schicht. u. Petrefakt. sächs.-böhm. Kreidegeb. 2nd edit. p. 63, pl. xvii. figs. 13, 14.

1850. *Odontaspis rhaphiodon*, F. Dixon, Foss. Sussex, pl. xxx. fig. 32.

(?) 1854. *Lamna raphiodon*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 392, pl. iii. figs. 27–38 (in part).

1856. *Lamna plicatella*, C. E. Fischer, Allg. deutsch. naturh. Zeit. n. s. vol. ii. p. 142, pl. ii. figs. 52, 53.

1857. *Oxyrhina zippei?*, P. Gervais, Zool. et Pal. Franç. 2nd edit. pl. lxxvi. fig. 14.

(?) 1871. *Enchodus striatus*, E. von Eichwald, Geogn.-Paläont. Bemerk. Halbinsel Manganischlak, p. 64, pl. iv. figs. 1, 2.

1872. *Odontaspis rhaphiodon*, H. E. Sauvage, Bibl. Ecole Hautes Etudes, vol. v. no. 9, p. 36, pl. i. figs. 42–53.

1873. *Enchodus serratus*, F. Stoliczka (*non* Egerton), Cret. Fauna S. India, (Pal. Ind.) vol. iv. pt. 4, p. 69, pl. xii. fig. 41.

1875. *Lamna raphiodon*, H. B. Geinitz, Palæontogr. vol. xx. pt. i. p. 295, pl. lxv. figs. 9–11.

1878. *Lamna striola*, St. Zarecznego, Sprawozd. Komisyi Fizyjograf. Galicyi, vol. xii. p. (204), pl. viii. fig. 6.

1878. *Lamna striatella*, St. Zarecznego, *tom. cit.* p. (205), pl. viii. fig. 10.

1878. *Lamna rhaphiodon*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 10, woodc. fig. 17.

Type. Detached teeth ; British Museum.

A larger species than either of the foregoing, known only by the dentition. Inner coronal face prominently striated. Anterior teeth without lateral denticles ; postero-lateral teeth with a single pair of sharp denticles.

Form. & Loc. Cenomanian : Russia and Galicia. Cenomanian and Turonian : France, Saxony, and Bohemia. Cenomanian—Senonian : S. England. U. Cretaceous : S. India and Manganischlak, Caspian Sea.

4582–3. Two type specimens figured by Agassiz, *loc. cit.* ; Chalk, Lewes, Sussex. *Mantell Coll.*

4578–80. Three anterior dental crowns, one with a portion of the root ; Lewes. *Mantell Coll.*

25889, 25890, 25946. Four dental crowns, one figured by Dixon, *loc. cit.* ; also a small tooth ; Chalk, Sussex. *Dixon Coll.*

P. 1252. Small lateral tooth : Chalk, Sussex. *Egerton Coll.*

43080. Perfect anterior tooth ; Chalk, Kent. *Purchased*, 1871.

P. 404. Similar tooth ; Chalk, probably from Kent.
Presented by the Earl of Ducie, 1881.

37755. Antero-lateral tooth, without denticles : English Chalk.
Purchased, 1863.

49952. Lateral tooth, with a pair of pointed lateral denticles ; Upper Chalk, Shalford, near Guildford. *Capron Coll.*

49948 a. Tooth ; Lower Chalk, Guildford. *Capron Coll.*

44216. Two dental crowns : Upper Chalk, Purley, Surrey.
Purchased, 1873.

46402. Two imperfect anterior teeth : Chalk, Warminster.
Cunnington Coll.

P. 5892. Much contorted anterior tooth ; Upper Chalk, Norwich.

44839. Two anterior teeth : English Chalk.
Presented by Benjamin Bright, Esq., 1873.

P. 5841. Three teeth : Danian beds, Malogne, near Ciply, Belgium.
Presented by Mons. A. Houzeau de Lehaie, 1888.

36326 a. Two teeth : Cambridge Greensand, Cambridge.
Purchased, 1862.

P. 5297. Seven small teeth, mostly imperfect : Cambridge Greensand, Cambridge. *History unknown.*

31315 a. Large dental crown : Upper Greensand, Belgium.

P. 300. P. 306. Three teeth : Planerkalk, Strehlen, near Dresden, Saxony. *Transferred from Mus. Practical Geology*, 1880.

P. 1251. Lateral tooth : (?) Strehlen. *Egerton Coll.*

37235. About thirty dental crowns : Planerkalk, Oušt́, near Labem, Bohemia. *Purchased*, 1863.

P. 5559 b. Seven teeth ; Cenomanian, Saratov, Russia.
By exchange, 1888.

Scapanorhynchus (?) subulatus (Agassiz).

1822. *Squalus cornubicus*, G. A. Mantell, Foss. S. Downs, p. 226, pl. xxxii. fig. 1.
1843. *Lamna* (*Odontaspis*) *subulata*, L. Agassiz, Poiss. Foss. vol. iii. p. 296, pl. xxxvii. *a*. fig. 5 (? figs. 6, 7).
(?) 1843. *Lamna* (*Odontaspis*) *rhaphiodon*, L. Agassiz (*errore*), *tom. cit.* pl. xxxvii. *a*. fig. 11.
1845. *Lamna undulata*, A. E. Reuss, Verstein. böhm. Kreideform. p. 8, pl. iii. figs. 45–48.
1845. *Odontaspis rhaphiodon*, A. E. Reuss, *op. cit.* pt. i. pl. iii. figs. 34–36.
1845. *Odontaspis constrictus*, Sir P. Egerton, Quart. Journ. Geol. Soc vol. i. p. 171, woodc.
1845. *Odontaspis oxyprion*, Sir P. Egerton, *ibid.* p. 171, woodc.
1846. *Lamna subulata*, A. E. Reuss, *op. cit.* pt. ii. p. 100, pl. xxiv. fig. 25.
1852. *Lamna* ?, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. fig. 21.
1854. *Lamna subulata*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 394, pl. iii. figs. 39–45.
1856. *Lamna subulata*, E. Hébert, Mém. Soc. Géol. France, [2] vol. v. p. 355, pl. xxvii. fig. 10.
1858. *Odontaspis subulata*, Pictet & Campiche, Foss. Terr. Crétacé St. Croix, p. 87, pl. xi. figs. 1–8.
1873. *Odontaspis constrictus*, F. Stoliczka, Cret. Fauna S. India, (Pal. Ind.) vol. iv. pt. 4, p. 68, pl. xii. figs. 35–37.
1875. *Lamna subulata*, H. B. Geinitz, Palæontogr. vol. xx. pt. ii. p. 209, pl. xxxviii. figs. 33–36 (? figs. 29, 30, 32, *non* fig. 31).
1878. *Lamna subulata*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 9, fig. 16 (*non* fig. 15).
(?) 1888. *Odontaspis kaikoraensis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 24, pl. v. figs. 6–10.
1888. *Lamna subulata*, S. Nikitin, Mém. Comité Géol. vol. v. no. 2, p. 40, pl. v. figs. 6, 7.

Type. Detached tooth: Palæontological Museum, Munich.

A species known only by detached teeth, and provisionally assigned to this genus. Inner coronal face smooth; lateral denticles always present and prominent, robust in the lateral teeth.

Form. & Loc. Albian—Senonian: S.E. England. Albian: Switzerland. Cenomanian: Central and S.E. Russia. Cenomanian and Turonian: Saxony and Bohemia. Senonian: N. France. Danian: Holland. Upper Cretaceous: S. India and New Zealand.

4569, 4573. Two small teeth: Chalk, Lewes. *Mantell Coll.*

25769, 25795, 25807, 25934, 25936. Seven teeth: Chalk, Sussex. *Dixon Coll.*

49949. Two teeth: Chalk, Arundel, Sussex. *Capron Coll.*

49947 a. Small anterior tooth: U. Chalk, Guildford. *Capron Coll.*

20289 a. Two teeth; Chalk, Greenhithe, Kent. *Purchased*, 1846.

41707. Two teeth: Chalk, Halling, Kent. *Toulmin Smith Coll.*

P. 332. Small tooth, probably to be regarded as the fourth of the upper jaw; Chalk, Charing, Kent. *Harris Coll.*

P. 2380. Tooth; Chalk, Kent. *Enniskillen Coll.*

P. 5755. Two teeth, one very imperfect: Grey Chalk, Dover, Kent. *Daniels Coll.*

35882. Tooth: Grey Chalk, Dover. *Purchased*, 1861.

P. 5756. Two teeth: Upper Chalk, Grays, Essex. *Daniels Coll.*

35653. Three teeth: Upper Chalk, Norwich. *Purchased*, 1859.

48956 a. Tooth: Upper Chalk, Norwich. *Bagfield Coll.*

P. 5757. Five imperfect teeth: Norwich. *History unknown.*

42985. Three teeth: Upper Chalk, Maastricht, Holland. *Van Breda Coll.*

42868 c. Tooth: Upper Chalk, Obourg, Hainaut, Belgium. *Van Breda Coll.*

28295 a. Twelve teeth: Upper Chalk, Mont Aimé, Marne, France. *Purchased*, 1851.

P. 5758. Five teeth: Chalk, locality unknown.

P. 1229. Dental crown: Chalk, Heytesbury, Wiltshire. *Egerton Coll.*

30541. Five dental crowns: Upper Greensand, Warminster. *Purchased*, 1856.

36326. Three teeth: Cambridge Greensand, Cambridge. *Purchased*, 1862.

39678. Tooth: Gault, Folkestone, Kent. *Purchased*, 1865.

47218, P. 12 a. Seven teeth: Gault, Folkestone. *Gardner Coll.*

P. 1238. One imperfect tooth: also three dental crowns, doubtfully assigned to this species: Plänerkalk, Strehlen, near Dresden, Saxony. *Egerton Coll.*

P. 2372. Imperfect tooth; Plänerkalk, Weinböhla, Saxony. *Enniskillen Coll.*

P. 5559. Twenty-eight teeth; Cenomanian, Saratov, Russia. *By exchange*, 1888.

P. 5559 a. Eight teeth, doubtfully assigned to the upper jaw of this species; Saratov. *By exchange*, 1888.

P. 596. Seventeen imperfect teeth of the so-called *Odontaspis constrictus*, Egert.; Pondicherry, Madras. *Egerton Coll.*

47885 a. Similar teeth; Pondicherry. *Presented by the Hon. Robert Marsham*, 1877.

P. 597. Seven teeth of the so-called *Odontaspis oxyprion*; Pondicherry. *Egerton Coll.*

P. 2304 a. Tooth of the form named *Odontaspis kaikoraensis*, Davis, noticed by the present writer, Geol. Mag. [3] vol. iii. (1886), p. 216; Neocomian, Amuri Bluff, New Zealand. *By exchange*, 1876.

The following teeth are also commonly assigned to the symphysis of the jaw of *S.* (?) *subulatus* (*e. g.* see H. B. Geinitz, Palæontographica, vol. xx. pt. ii. pl. xxxviii. figs. 29, 30, 32); but some are very suggestive of anterior teeth of the so-called *Otodus sulcatus*, Geinitz, the long pointed lateral denticles and both faces of the crown being vertically plicated at the base.

4581. Small anterior dental crown, figured by Agassiz (*loc. cit.*) among the type specimens of *Lamna* (*Odontaspis*) *rhaphiodon*; Chalk, Lewes. *Mantell Coll.*

49949 a. Two examples; Chalk, Arundel, Sussex. *Capron Coll.*

41707 a. One tooth; Chalk, Halling, Kent. *Toulmin Smith Coll.*

44030. Another similar specimen; Upper Chalk, Warne's Place, Rochester, Kent. *Purchased*, 1873.

47218 a. One tooth; Gault, Folkestone. *Gardner Coll.*

P. 2300. Much sulcated tooth; Atherfield Clay ("Lobster Bed"), Isle of Wight. *Presented by Mrs. Burton*, 1882.

Scapanorhynchus (?) **gigas**, sp. nov.

Type. Imperfect teeth; British Museum.

Teeth very slender, often sigmoidally curved, subulate, but with sharp edges; external coronal face flat, except in the most anterior

teeth: internal face smooth. Crown attaining a maximum height of about 0·03, expanded laterally at the base, the sharp edges extending to its inferior limit; lateral denticles absent, or mere asperities in the anterior teeth, very minute in the others.

Foss. & Loc. Cenomanian (Cambridge Greensand): Cambridgeshire.

46362. Five teeth, with imperfect roots, forming the type specimens. The crown of one anterior tooth measures 0·03 in height, and the outer face is slightly convex.

Purchased, 1875.

28109. Three small examples, one showing a slight longitudinal median elevation of the outer coronal face.

Presented by James Carter, Esq., 1852.

41915. Four dental crowns. *Purchased*, 1870.

35130. Eight specimens. *Purchased*, 1859.

The following specimens may belong to the so-called *Odontaspis studeri*, Pictet[1] (Pictet & Campiche, Foss. Terr. Crétacé St. Croix, 1858, p. 99, pl. xi. figs. 19–23), from the Neocomian of Switzerland: but the evidence is insufficient for satisfactory comparison:—

P. 5759. Five imperfect teeth: Neocomian, near Folkestone, Kent.

The teeth from the Neocomian of Switzerland, named *Lamna (Odontaspis) gracilis*, L. Agassiz (Poiss. Foss. vol. iii. 1843, p. 295, pl. xxxvii. *a*. figs. 2–4), are also perhaps referable to this genus: and teeth of the same form, from the Lower Cretaceous of Apt, Vaucluse, are recorded by E. Arnaud (Bull. Soc. Géol. France, (3) vol. x. (1882), p. 133)[2]. Gibbes[3] and Giebel[4] identify the species with *S. subulata*.

Possibly also may be placed here a detached dental crown, from the White Chalk of Manganischlak, Caspian Sea, named *Oxyrhina angustidens* by E. von Eichwald (Geogn.-paläont. Bemerk. Halbinsel Manganischlak, 1871, p. 66, pl. iv. figs. 4, 5).

[1] Teeth seems to be the species provisionally named *Odontaspis dessori*, Pictet, in the Archiv. Sci. Phys. et Nat. 1858, p. 240.

[2] Teeth from the Bracklesham beds are also assigned to this species by T. C. Winkler, Archiv. Mus. Teyler, vol. iii. (1874), p. 298, pl. vii. fig. 8.

[3] R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. (2) vol. i. (1849), p. 198.

[4] C. G. Giebel, Fauna d. Vorw., Fische (1847), p. 362.

Genus **ODONTASPIS**, Agassiz.

[Poiss. Foss. vol. iii. 1838, p. 87.]

Syn. *Triglochis*, Müller & Henle, Mag. Nat. Hist. n. s. vol. ii. 1838, p. 88.

(?) *Oxytes*, C. G. Giebel, Fauna der Vorwelt, Fische, 1847, p. 364.

Second dorsal fin and the anal of equal size, scarcely smaller than the first dorsal. No pit at the root of the caudal: side of the tail without keel. Teeth of all but the few hindermost series with a high, narrow, compressed coronal eminence, flanked by one or two pairs of small pointed denticles; the fourth tooth from the symphysis upon each side of the upper jaw very small: the teeth of the most anterior pair in the lower jaw small and relatively very slender.

As remarked by Agassiz, it is very difficult to distinguish the teeth of this genus from those of *Lamna*, the only difference apparently being the greater relative size and more subulate character of the anterior teeth in *Odontaspis*. From *Scapanorhynchus* the teeth differ in no essential respects.

Odontaspis bronni, Agassiz.

1843. *Lamna* (*Odontaspis*) *bronni*, L. Agassiz, Poiss. Foss. vol. iii. p. 297, pl. xxxvii. *a*. figs. 8–10.

(?) 1843. *Otodus serratus*, L. Agassiz, *tom. cit.* p. 272, pl. xxxii. figs. 27, 28.

1852. *Otodus* and *Lamna*, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. figs. 6, 8[1].

Type. Detached tooth.

Teeth robust, the crown of the anterior teeth attaining a height of about 0·018, with but the slightest sigmoidal curvature. Outer coronal face convex, more or less uneven, and sometimes vertically folded towards the basal line, which is transversely straight; inner face smooth; two pairs of pointed lateral denticles generally present, the outer insignificant. Base of crown in lateral teeth overhanging the root in front. Nutritive foramen of the root in a deep groove.

The upper postero-lateral teeth are probably those named *Otodus serratus*, Agassiz.

The teeth of *O. acuta*, J. W. Davis, from the Oamaru System of New Zealand, are very similar to those of this species.

Form. & Loc. Danian: Holland and Belgium.

42984. Six teeth; Maastricht. *Van Breda Coll.*

[1] To this species may also probably be assigned the Maastricht tooth named *Odontaspis hopei* by F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vii. (1880), p. 16, pl. c. fig. 1.

44842. An anterior and a small lateral tooth: Maastricht.
Presented by Benjamin Bright, Esq., 1873.

P. 1250. Small anterior tooth mentioned by Agassiz, *tom. cit.* p. 297: Maastricht. *Egerton Coll.*

P. 1282. Three teeth; Maastricht. *Egerton Coll.*

P. 4572. An anterior and a lateral tooth: Maastricht.
Enniskillen Coll.

P. 5556 One perfect anterior tooth, and three abraded examples: Craie de Ciply, Belgium. *By exchange*, 1888.

P. 5555. Lateral tooth; Ciply. *By exchange*, 1888.

P. 5829. Two teeth; Ciply.
Presented by Mons. A. Houzeau de Lehaie, 1888.

42868 a. Tooth: Obourg, Hainaut, Belgium. *Van Breda Coll.*

Odontaspis rutoti (Winkler).

1876. *Otodus rutoti*, T. C. Winkler, Archiv. Mus. Teyler, vol. ix. fasc. 1, p. 4, pl. i. figs. 3, 4.

1876. *Otodus rutoti*, G. Vincent, Ann. Soc. Roy. Malacol. Belg. vol. xi. p. 124, pl. vi. figs. 1 *a–e*.

Type. Detached teeth.

Teeth almost indistinguishable from those of *O. hopei*, but often with a greater development of lateral denticles, and the anterior teeth apparently never with a straight anterior coronal base-line.

Form. & Loc. Heersian, Landenian, and Ypresian: Belgium. Thanet Sands: England.

P. 4933. Two teeth; Heersian, Orp-le-Grand.
Presented by G. F. Harris, Esq., 1885.

P 4102. Four teeth: Thanet Sands, Reculvers, Kent.
Presented by Sydney C. Cockerell, Esq., 1883.

Odontaspis elegans (Agassiz).

1776. *Dentes Squali*, G. Brander, Foss. Hantoniensia, pl. ix. figs. 113, 114.

1843. *Lamna elegans*, L. Agassiz, Poiss. Foss. vol. iii. p. 289, pl. xxxv. figs. 1–5 (*non* figs. 6, 7), pl. xxxvii. *a*. fig. 59 (*non* fig. 58).

1849. *Lamna elegans*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. 2, vol. i. p. 196, pl. xxv. figs. 98–102 (? figs. 96, 97).

1850. *Lamna elegans*, F. Dixon, Foss. Sussex, p. 393, pl. x. figs. 28–31.

1852. *Lamna elegans*, P. Gervais, Zool. et Pal. Franç. pl. lxxv. fig. 3.

1863. *Lamna elegans*, K. E. Schafhäutl, Süd-Bay. Leth. Geogn. p. 242, pl. lxii. fig. 6.
1871. *Lamna elegans*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 12.
1875. *Lamna elegans*, A. Rutot, Ann. Soc. Géol. Belg. vol. ii. p. 34.
1876. *Lamna elegans*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. p. 9.
1876. *Lamna elegans*, G. Vincent, Ann. Soc. Roy. Malacol. Belg. vol. xi. p. 123, pl. vi. fig. 4.
1877. *Lamna elegans*, A. Locard, Faune Terr. Tert. Moy. Corse, p. 5.
1880. *Lamna elegans*, T. C. Winkler, Archiv. Mus. Teyler, vol. v. p. 74.
1883. *Lamna elegans*, H. B. Geinitz, Abh. Naturw. Ges. Isis Dresden p. 5, pl. i. figs. 4–6.
1885. *Lamna elegans*, F. Noetling, Abh. Geol. Specialk. Preussen u Thüring. Staaten, vol. vi. pt. 3, p. 61, pl. iv.
1888. *Lamna huttoni*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv p. 15, pl. iii. fig. 1.

Type. Detached teeth.

Teeth slender, the inner coronal face marked by delicate but prominent longitudinal striæ[1]; a single pair of small pointed lateral denticles; the two branches of the root long, stout, compressed, and generally pointed. Anterior teeth very much elevated and narrow, sometimes attaining a total height of 0·065, the long crown slightly curved, but scarcely sigmoidal when viewed from the lateral aspect: outer coronal face flat or faintly convex; lateral edges prominent; inner face strongly convex, slightly flattened in the middle; angle between the branches of the root acute. More posterior teeth with less elevated crowns, broader base, wider angle between the branches of the root, and relatively larger lateral denticles.

The dentition approximates much more closely to that of *Odontaspis* than to that of *Lamna*, a fact apparently only hitherto recognized by O. G. Costa, Paleont. Regno Napoli, pt. i. (1850), p. 127.

Among the specimens originally assigned to this species by Agassiz are three teeth (*op. cit.* pl. xxxv. figs. 6, 7, pl. xxxvii. *a*. fig. 58) which appear to be truly referable to *Lamna* (*Otodus*) *macrota*; and it would be unsafe at present to accept all the determinations of teeth from various horizons recorded without figures in many stratigraphical works. Noetling (*loc. cit.*) has attempted to determine the variation in form exhibited by the teeth of different parts of the mouth.

Form. & Loc.[2] (?) Upper Danian: Belgium. Eocene: S.E.

[1] On the Striation of Selachian Teeth, see J. Probst, Württ. Jahresh. vol. xv. (1859), p. 100.

[2] See especially A. Rutot, "Note sur l'Extension de *Lamna elegans*, Ag., à

England, France, Belgium, and Germany; also Alabama and South Carolina, U.S.A. Lower Miocene: Belgium and Corsica. Oamaru and Waireka Series: New Zealand [1].

P. 5831. Two dental crowns, either of this species or of the so-called *Lamna levis* (see p. 353): Crale phosphatée, Ciply, near Mons, Belgium.
Presented by Mons. A. Houzeau de Lehaie, 1888.

8566. Slender anterior tooth of medium size: Woolwich and Reading Beds, Newhaven, Sussex. *Mantell Coll.*

P. 5763. Fragmentary teeth: Oldhaven Beds, Herne Bay, Kent.

P. 4726 a. Tooth; Herne Bay. *Gardner Coll.*

P. 4932. Seven small slender teeth, none measuring more than 0·015 in total height: Heersian Beds, Orp-le-Grand, Brussels, Belgium. *Presented by G. F. Harris, Esq.*, 1885.

P. 5508. Imperfect tooth: Lower Eocene, Portsmouth Docks.
Caleb Evans Coll.

40232. 40239. Eight teeth, more or less fragmentary; also three small lateral teeth, either of this species or *O. cuspidata*: London Clay, Clarendon Hill, near Salisbury.
Edwards Coll.

38867. Tooth associated with cartilage and vertebræ, figured in Agassiz's Poiss. Foss. vol. iii. pl. xl. *b*. fig. 24: London Clay, Isle of Sheppey. *Bowerbank Coll.*

28358. Eleven teeth, corresponding in size to the last: Sheppey.
Cowderoy Bequest.

28887. Ten small teeth; Sheppey. *Purchased*, 1854.

P. 5764. Ten teeth, the largest having a total height of 0·065: Sheppey. *Purchased*, 1882.

P. 1237. Very broad dental crown, in matrix, with two vertebræ; Sheppey. *Egerton Coll.*

P. 2377. Five teeth with comparatively broad crowns: Sheppey.
Enniskillen Coll.

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travers les Terrains crétacés et tertiaire," *loc. cit.* Very doubtful teeth are also recorded from the Miocene of Piedmont by E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. (1849), p. 46, pl. ii. figs. 33–35.

[1] This species is also recorded from the Miocene of Victoria by F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx. (1867), p. 192.

P. 4643. Fragments of teeth, with cartilage, in matrix; Sheppey. *Enniskillen Coll.*

P. 5765. Four teeth; London Clay, Primrose Hill, London. *Brown Coll. Presented by Sir Richard Owen, K.C.B., 1859.*

43115. Large tooth, measuring 0·045 in total height; Primrose Hill. *Wetherell Coll.*

20205*. Small slender tooth; London Clay, Highgate Archway, London. *Presented by N. T. Wetherell, Esq., 1833.*

43112. Two dental crowns and one tooth, with perforations supposed to have been made by *Cliona*; Highgate Archway. *Wetherell Coll.*

P. 5509. Two teeth; Highgate Archway. *Caleb Evans Coll.*

43121. Tooth, with perforations supposed to have been made by *Cliona*; London Clay, Finchley, London. *Wetherell Coll.*

P. 1230. Four teeth and five dental crowns: London Clay, Hertford Bridge. *Egerton Coll.*

43122. Two large teeth the largest 0·062 in total height; London Clay, Southampton Docks. *Wetherell Coll.*

29017. Thirty-three teeth, mostly of small size, and mostly abraded and fragmentary; from a bed of sand at the base of the London Clay, Kyson (Kingston), near Woodbridge, Suffolk. *Presented by J. Middleton, Esq., 1854.*

P. 1246. Tooth; Kyson. *Egerton Coll.*

25683–4. Ten teeth, four being very large; Bracklesham Beds, Bracklesham Bay, Sussex. *Dixon Coll.*

40235 a. Lateral tooth; Bracklesham Bay. *Edwards Coll.*

48013. Two teeth; Bracklesham Beds, Stubbington, near Gosport, Hampshire. *Purchased, 1877.*

P. 4501. Small tooth; Middle Eocene, Antibes, Provence.

P. 5766. Twelve teeth, of medium and small size; Calcaire Grossier, Roquet, Paris.

28368, 28850. Five dental crowns; Calcaire Grossier, Parnes, Paris. *Purchased, 1853.*

P. 5797. Two teeth: Calcaire Grossier, Chaumont, Paris.

28365. Three very large teeth: Calcaire Grossier, Paris.
Purchased, 1853.

P. 5787. Imperfect tooth: Middle Eocene, Gard, France.

28094. Four small teeth: Barton Clay, Barton Cliff, Hampshire.
Presented by F. E. Edwards, Esq., 1852.

40228, 40231, 40234, 40237, 40244. Forty teeth, many more or less fragmentary: Barton Clay, Barton Cliff and High Cliff, Hampshire. *Edwards Coll.*

P. 1164. Sixteen teeth, some large: Barton Cliff. *Egerton Coll.*

P. 5763. Six teeth, the largest 0·04 in total height: Barton Cliff.
Enniskillen Coll.

40236. Two large teeth, one 0·06 in total height: Upper Eocene, Bramshaw, Hampshire. *Edwards Coll.*

40229. Two teeth, with long slender lateral denticles: Upper Eocene, Bramshaw, Hampshire. *Edwards Coll.*

40233. Tooth: Upper Eocene, Burn Heath, Calling. *Edwards Coll.*

40230. Tooth: Upper Eocene, Hempstead, Isle of Wight.
Edwards Coll.

P. 1231. Six teeth; Upper Eocene, Brussels. *Egerton Coll.*

P. 4365. Three teeth; Rupelian Beds, Boom, near Antwerp.
Enniskillen Coll.

35540. Twelve abraded dental crowns: Rupelian Beds, Klein Spauwen, Belgium. *Purchased*, 1875.

P. 5769. Two small teeth: Klein Spauwen. *Purchased.*

42851. Fine large tooth: Brussels. *Van Breda Coll.*

28353. Six very large teeth, somewhat imperfect; said to have been obtained from the Miocene of Dax, near Bordeaux. In character they are very similar to those of No. 28365.
Purchased, 1853.

35611. Eight imperfect teeth: Eocene, Alabama, U.S.A.
Presented by Prof. J. W. Mallet, 1859.

P. 5770. Abraded tooth, of the form named *Lamna huttoni*, Davis; formation unknown, New Zealand.

42019. Five fragmentary small teeth; formation unknown, Canterbury, New Zealand.

Presented by J. Davies Enys, Esq., 1870.

The following is one of the hindermost teeth, probably of this species:—

P. 5743. Small tooth, with three pairs of lateral cones: Heersian Beds, Orp-le-Grand, Belgium.

Presented by G. F. Harris, Esq., 1888.

Odontaspis contortidens, Agassiz.

1843. *Lamna* (*Odontaspis*) *contortidens*, L. Agassiz, Poiss. Foss. vol. iii. p. 294, pl. xxxvii. *a*. figs. 17–23.

1849. *Lamna* (*Odontaspis*) *contortidens*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 48, pl. ii. figs. 25–28.

1849. *Lamna* (*Odontaspis*) *contortidens*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 197, pl. xxvi. fig. 119.

1857. *Lamna* (*Odontaspis*) *contortidens*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 320, pl. i. *a*. fig. 13 *a* (? pl. vi. *a*. f. 18–20).

1864. *Lamna* (*Odontaspis*) *contortidens*, O. G. Costa, Ann. Accad. Aspir. Nat. Napoli, [3] vol. iii. p. 30, pl. v. fig. 2.

1877. *Lamna contortidens*, A. Locard, Faune Terr. Tert. Moy. Corse, p. 7.

1879. *Lamna* (*Odontaspis*) *contortidens*, J. Probst, Württ. Jahresh. vol. xxxv. p. 144, pl. ii. figs. 33–39.

1879. *Odontaspis contortidens*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 57.

1882. *Odontaspis contortidens*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 50.

Type. Detached teeth.

Teeth slender, with delicate longitudinal striæ upon the inner coronal face, and only distinguished from those of *Odontaspis elegans* by the pronounced sigmoidal curvature of those occupying the anterior portion of the jaw.

The teeth at least of the most anterior pair in the upper jaw of all species of *Odontaspis* exhibit considerable sigmoidal curvature; but in *O. contortidens* all the front teeth seem to be thus characterized, and in such the inward projection of the base of the root is much greater than in *O. elegans*. By Le Hon[1] the species is placed with *O. elegans*, and it does appear to be the representative of this

[1] Prélim. Mém. Poiss. Tert. Belg. 1871, p. 12.

form in the Miocene and Pliocene; but the teeth do not attain to so large a size.

Form. & Loc. Upper Eocene: France. Miocene: Belgium, France, Spain, Switzerland, Germany, Austria, Sicily, Malta, and Corsica. Pliocene: France. (?) Eocene: Alabama and South Carolina, U.S.A.[1]

P. 1257. Tooth; Upper Eocene, Vaucluse, France. *Egerton Coll.*

35540 a. Perfect tooth: Rupelian Beds, Klein Spauwen, Belgium. *Purchased*, 1875.

28367 a. Five imperfect teeth: Miocene, Bordeaux. *Purchased*, 1853.

28367. Two teeth, one very perfect, 0·028 in total height: Miocene, Martigues, Provence. *Purchased*, 1853.

P. 1244. Dental crown: Miocene, Ardèche. *Egerton Coll.*

33644. Tooth wanting branches of the root: Miocene, Tejares, Malaga, Spain. *Purchased*, 1860.

32735. Nearly perfect tooth: Miocene, Xabregas, Lisbon. *Presented by J. S. Valentine, Esq.*, 1857.

P. 1241. Seven fragmentary teeth, bearing Agassiz's MS. label: Miocene, Soleure, Switzerland. *Egerton Coll.*

P. 5771. Twelve fragmentary teeth: Soleure. *Enniskillen Coll.*

P. 5553. Two teeth: Miocene, Montegibio. *By exchange*, 1888.

P. 1242. Four teeth: Lower Miocene, Alzey, Hessen-Darmstadt. *Egerton Coll.*

P. 5774. Small dental crown: Miocene, Baltringen, Wurtemberg. *Enniskillen Coll.*

P. 1245 a. Five dental crowns: Miocene, Malta. *Egerton Coll.*

P. 1243. Imperfect tooth: Neudörfl, Vienna. *Egerton Coll.*

P. 5772. Two teeth; Neudörfl. *Purchased.*

P. 293 a. Six imperfect teeth, possibly of this species: Pliocene, Montpellier, France. *Transferred from Mus. Practical Geology*, 1880.

[1] This species is also recorded from the Miocene of Victoria by F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx. (1867), p. 192.

47005. Nine teeth; Phosphate Beds, South Carolina, U.S.A. *Purchased*, 1876.

P. 5773. Dental crown, probably of this species; Eocene, Clarke's Co., Alabama. *Enniskillen Coll.*

28360. Twenty much abraded teeth, probably all of this species; Faluns of Touraine, France. *Purchased*, 1853.

Odontaspis cuspidata (Agassiz).

1843. *Lamna cuspidata*, L. Agassiz, Poiss. Foss. vol. iii. p. 290, pl. xxxvii. *a*. figs. 43–50.

1843. *Lamna denticulata*, L. Agassiz, *tom. cit.* p. 291, pl. xxxvii. *a*. figs. 51–53[1].

1843. *Lamna* (*Odontaspis*) *hopei*, L. Agassiz, *tom. cit.* p. 293, pl. xxxvii. *a*. figs. 27–30.

1843. *Lamna* (*Odontaspis*) *dubia*, L. Agassiz, *tom. cit.* p. 295, pl. xxxvii. *a*. figs. 24–26.

1849. *Lamna cuspidata*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 197, pl. xxv. figs. 103–106.

1849. *Lamna cuspidata*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 47, pl. ii. figs. 31, 32 (? figs. 29, 30).

1849. *Lamna* (*Odontaspis*) *dubia*, E. Sismonda, *tom. cit.* p. 48, pl. ii. figs. 17–22.

1852. *Lamna dubia*?, P. Gervais, Zool. et Pal. Franç. pl. lxxv. fig. 5.

(?) 1857. *Lamna* (*Odontaspis*) *dubia*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 322, pl. vi. *a*. fig. 21.

1871. *Lamna cuspidata*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. pp. 5, 10.

1871. *Lamna* (*Odontaspis*) *hopei*, H. Le Hon, *op. cit.* p. 12.

1876. *Lamna cuspidata*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. p. 10.

1877. *Lamna cuspidata*, A. Locard, Faune Terr. Tert. Moy. Corse, p. 6.

1877. *Lamna cuspidata*, K. Miller, Das Molassemeer Bodenseegeg. p. 66, pl. iii. figs. 75, 76.

1879. *Lamna* (*Odontaspis*) *cuspidata*, J. Probst, Württ. Jahresh. vol. xxxv. p. 149, pl. ii. figs. 59–63.

1879. *Odontaspis hopei* = *Lamna* (*Odontaspis*) *dubia*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 57.

1882. *Lamna cuspidata*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 48, pl. i. figs. 15, 16.

1883. *Lamna cuspidata*, H. B. Geinitz, Abh. Naturw. Ges. Isis Dresden, p. 5, pl. i. figs. 1–3.

1885. *Odontaspis hopei*, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3, p. 71, pl. v. figs. 1–3.

[1] Under this name teeth from the Miocene of Victoria are also recorded by F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx. (1867), p. 192.

Type. Detached teeth; Neuchatel Museum.

Teeth scarcely distinguishable from those of *O. elegans*, except by the absence of striæ upon the inner coronal face. They are sometimes more robust than the corresponding teeth of the last-named species, and do not appear to attain so large a size.

Lamna denticulata is commonly regarded as founded upon an upper lateral tooth of this species. *L. dubia* is placed in the synonymy by Le Hon, Bassani, and Sauvage.

Form. & Loc. Eocene: S.E. England, France, and Germany; also Georgia, Virginia, and (?) Alabama, U.S.A. Miocene: Belgium, France, Spain, Switzerland, Germany, Austria, and Corsica.

P. 4726. Five small teeth: Lower Eocene, Herne Bay, Kent.
Gardner Coll.

29017 a. Four teeth, and one small tooth perhaps of this species; from a bed of sand at the base of the London Clay at Kyson (Kingston), near Woodbridge, Suffolk.
Presented by J. Middleton, Esq., 1854.

P. 5512. Fine tooth: London Clay, Portsmouth.
Caleb Evans Coll.

28763. Anterior portion of the jaws, with a few teeth and a fragment of a vertebra, preserved in hard clay: London Clay, Isle of Sheppey. The extremely narrow first tooth characteristic of each side of the mandible in the living species is not recognizable: but the next two teeth are well shown, very long and slender, and much more contorted than those beyond. Of the latter teeth two are preserved on the right side: and in these the minute pointed lateral denticles are relatively larger than in the more slender contorted teeth. *Purchased*, 1853.

28356, 28886. Four teeth: London Clay, Sheppey.
Cowderoy Bequest and Daniels Coll.

P. 1249. Three teeth; Sheppey. *Egerton Coll.*

P. 5775. Two anterior teeth, labelled "*Odontaspis hopei*" by Agassiz; Sheppey. *Enniskillen Coll.*

P. 5510. Three small teeth; London Clay, Highgate.
Caleb Evans Coll.

28852. Small lateral tooth, probably of this species; Lower Eocene, Cuise-la-Motte, Oise, France. *Purchased*, 1854.

40238. Twelve teeth, mostly imperfect; Bracklesham Beds, Bracklesham Bay, Sussex. *Edwards Coll.*

40237. Twenty teeth, two extremely slender and suggestive of the most anterior pair of the lower jaw; Barton Clay, Barton Cliff, Hampshire. *Edwards Coll.*

P. 55 a. Tooth; Barton Cliff.
Presented by Sir Richard Owen, K.C.B., 1880.

P. 5776. Slender tooth; Upper Eocene, Brockenhurst, Hampshire. *Purchased.*

40240. Three teeth; Upper Eocene, Headon Hill, Isle of Wight. *Edwards Coll.*

32564. Six abraded teeth; Upper Eocene, Villeneuve d'Asiques, Gard, France. *Purchased*, 1857.

P. 281. Seven teeth: Rupelian Beds, Boom, near Antwerp.
Presented by Prof. L. G. de Koninck, 1853.

P. 1248. Ten teeth; Boom. *Egerton Coll.*

P. 2375, P. 2378. Sixteen teeth; Boom. *Enniskillen Coll.*

P. 4365 a. Four teeth; Boom. *Enniskillen Coll.*

P. 5777. Three teeth; Rupelian, Rupelmonde, Belgium. *Purchased.*

P. 1235. Abraded dental crown; Rupelian, Klein Spauwen, Belgium, *Egerton Coll.*

P. 1232. Twelve more or less abraded teeth; Miocene, Soleure, Switzerland. *Egerton Coll.*

P. 2379, P. 2379 a. Five typical teeth; also six lateral teeth labelled "*Lamna denticulata*" by Agassiz; Soleure.
Enniskillen Coll.

P. 5778. Tooth and two dental crowns; Soleure.

P. 1233. Six teeth; Miocene, Otmarsingen, Aargau, Switzerland.
Egerton Coll.

22658. Two teeth; Miocene, Lausanne, Switzerland.
Purchased, 1848.

43525. Lateral tooth; Lausanne.
Presented by Kenneth Murchison, Esq., 1872.

32582. Slender anterior tooth; Swiss Molasse. *Purchased*, 1857.

P. 5779. Four teeth; Miocene, Weinheim, Hessen-Darmstadt.
Edwards Coll.

47347. Eight teeth; Miocene, Flonheim, Hessen-Darmstadt.
Brown Coll. Presented by Sir Richard Owen, K.C.B., 1859.

P. 1234. Six teeth; Flonheim. *Egerton Coll.*

29888. Two teeth; Miocene, Baltringen, Würtemberg.
Purchased, 1855.

35768–9. Two teeth; Miocene, Ermingen, Wurtemberg.
Purchased, 1860.

24595. Tooth, said to have been obtained from the Miocene of Malta. *Purchased*, 1850.

P. 1243 a. Two teeth; Miocene, Neudörfl, Vienna. *Egerton Coll.*

P. 5780. Five teeth; Neudörfl. *Purchased.*

28362. Six teeth, mostly large and robust, much resembling *O. crassidens*: Miocene, Touraine, France. *Purchased*, 1853.

32735. Tooth: Miocene, Xabregas, Lisbon.
Presented by J. S. Valentine, Esq., 1857.

P. 5781. Six teeth, probably of this species: Eocene, South Carolina, U.S.A. *Purchased.*

Most of the following abraded teeth, from the Eocene of Alabama, may also pertain to the present species; but the determination is very doubtful:—

35611 a. Eight specimens. *Presented by Prof. J. W. Mallet*, 1859.

P. 1247. Ten specimens. *Egerton Coll.*

P. 5782. Three specimens. *Enniskillen Coll.*

Odontaspis complanata (Egerton).

1845. *Lamna complanata*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. i. p. 170, woodcut.

1845. *Lamna sigmoides*, Sir P. Egerton, *ibid.* p. 170, woodcut.

Type. Detached tooth; British Museum.

A species of moderate size, the crowns of the teeth much compressed, and none exhibiting a pronounced sigmoidal curvature; outer coronal face considerably flattened, inner face smooth, and the edges extremely sharp; a single pair of small lateral denticles.

Form. & Loc. Upper Cretaceous: Madras, India. Waitaki Beds: New Zealand.

P. 595. Two lateral teeth, one being the type specimen; Pondicherry, Madras. *Egerton Coll.*

P. 5155. Anterior tooth, and fragment of crown, of the form named *L. sigmoides*; Pondicherry. *Egerton Coll.*

P. 291. Similar dental crown; Waitaki Series, Takiroa, Waitaki, New Zealand. *Transferred from Mus. Practical Geology*, 1880.

Odontaspis incurva (Davis).

1888. *Lamna incurva*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 17, pl. iii. figs. 2–5.

Type. Detached teeth; Museums of Canterbury and Otago, New Zealand.

Teeth robust, the crown of those placed anteriorly sometimes attaining a height of 0·035, with a more or less marked sigmoidal curvature. Outer coronal face prominently convex; inner face smooth; cutting-edges obtuse, almost or quite disappearing near the base; a single pair of lateral denticles, very minute.

Form. & Loc. Oamaru and Waipara Systems, and the Waiteka Series: New Zealand.

P. 271. Four dental crowns; Otatara series, three miles N. of Kakanui. *Transferred from Mus. Practical Geology*, 1880.

P. 2307 a. Large dental crown, with base of minute lateral denticle; Oamaru System, Tokomariri. *By exchange*, 1876.

P. 2303 a. Abraded dental crown: Otatara series, Trelissic, Canterbury. *By exchange*, 1876

P. 2303 b. Three comparatively slender small dental crowns: Otatara series, Trelissic. *By exchange*, 1876.

P. 2307 b. Robust tooth, probably of this species, with the outer face remarkably flat, one edge sharp and the other rounded: Oamaru System, Tokomariri. *By exchange*, 1876.

Odontaspis vorax, Le Hon.

1871. *Lamna (Odontaspis) vorax*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. pp. 5, 10.

Type. Detached tooth; Brussels Museum.

Teeth slender, those anteriorly placed being much curved and attaining a total height of about 0·025; branches of the root short. Outer coronal face prominently convex; inner face smooth: lateral denticles long, slender, and pointed, in two or more pairs, the inner pair being always much the largest.

Form. & Loc. Miocene and Pliocene: Belgium. Pliocene: Tuscany.

47025. Two anterior teeth, only differing from that outlined by Le Hon by the relatively greater length and slenderness of the crown; Lucardo, Tuscany. *Purchased*, 1875.

Odontaspis (?) crassidens, Agassiz.

1843. *Lamna crassidens*, L. Agassiz, Poiss. Foss. vol. iii. p. 292, pl. xxxv. figs. 8–21.

1849. *Lamna crassidens*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 197, pl. xxvi. figs. 116–118.

1857. *Lamna crassidens*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 318, pl. vi. *a*. figs. 15, 16.

1879. *Lamna crassidens*, J. Probst, Württ. Jahresh. vol. xxxv. p. 153, pl. ii. figs. 64–68.

Type. Detached teeth.

Teeth robust, attaining a maximum total height of about 0·04; apex of crown only slightly bent inwards, except in the most anterior pair; outer coronal face gently convex; inner coronal face strongly convex, flattened in the middle, smooth. Branches of the root of moderate length, compressed; considerably divergent in the most anterior teeth.

As remarked by Agassiz, the detached crowns of the teeth of this species can scarcely be distinguished from those of *Oxyrhina desorii*.

Form. & Loc. Eocene: Baden, Sicily, and South Carolina, U.S.A. Miocene: Würtemberg.

35537. Thirteen teeth; Upper Eocene, Moeskirch, Baden.
Purchased, 1859.

The following species have also been founded upon detached teeth, but there are no examples in the Collection :—

Odontaspis acutissima, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 294, pl. xxxvii. *a*. figs. 33, 34; F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. (1879), p. 56.—Miocene: Switzerland and W. France.

Odontaspis acuta, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. (1888), p. 22, pl. v. figs. 1, 2.—Oamaru System; New Zealand.

Odontaspis aduncа: *Lamna aduncа*, O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 72.—Miocene; Naples.

Odontaspis angustus, C. G. Giebel, Fauna d. Vorw., Fische (1847), p. 363.—Upper Eocene; Süldorf, Magdeburg.

Odontaspis attenuata: *Lamna attenuata*, J. W. Davis, *tom. cit.* p. 19, pl. iii. fig. 11.—Oamaru System; New Zealand.

(?) *Odontaspis carinata*: *Lamna carinata*, J. W. Davis, *tom. cit.* p. 21, pl. iii. fig. 13.—Waipara Series; New Zealand.

Odontaspis duplex, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 297, pl. xxxvii. *a*. fig. 1.—Form. & loc. unknown.

Odontaspis exigua, J. W. Davis, *tom. cit.* p. 23, pl. v. figs. 3–5.—Oamaru System; New Zealand.

Odontaspis gustroviensis, T. C. Winkler, Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. (1875), p. 98, pl. ii. figs. 1, 2.—Miocene; Sternberg.

Odontaspis lineata, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 147, pl. ii. figs. 40–46.—Molasse; Baltringen, Würtemberg.

Odontaspis lupus, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. 1871, p. 5, woodc.—Pliocene; Belgium.

Odontaspis mirabilis, C. G. Giebel, *tom. cit.* p. 363.—Upper Eocene; Süldorf, near Magdeburg.

Odontaspis molassica, J. Probst, *tom. cit.* p. 150, pl. ii. figs. 47–52.—Molasse; Baltringen.

Odontaspis pygmæa: *Lamna?* (*Odontaspis*) *pygmæa*, G. von Münster, Beitr. Petrefakt. vii. (1846), p. 23.—Miocene: Vienna.

(?) *Odontaspis regularis*, C. G. Giebel, *tom. cit.* p. 362.—Cretaceous: Quedlinburg.

Odontaspis reticulata, J. Probst, *tom. cit.* p. 145, pl. ii. figs. 26–32.—Molasse; Baltringen.

Odontaspis rigida: *Lamna rigida*, J. Probst, *tom. cit.* p. 152, pl. ii. figs. 53–58.—Molasse; Baltringen.

Odontaspis van-den-broecki, T. C. Winkler, Archiv. Mus. Teyler, vol. v. (1880), p. 77, woodcut fig. 3.—Upper Eocene; Limbourg, Belgium.

Odontaspis verticalis, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 294, pl. xxxvii. *a*. figs. 31, 32; R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1849), p. 198, pl. xxvi. figs. 124–127; W. Dames, Sitzungsb. k. preuss. Akad. Wiss. Berlin, 1883, pt. i. p. 145, pl. iii. figs. 8–10. *Otodus minutissimus*, T. C. Winkler, Archiv. Mus. Teyler, vol. iii. (1874), p. 297, pl. vii. fig. 2, and *ibid.* vol. iv. (1876), p. 23; Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. (1875), p. 110. *Otodus parvus*, T. C. Winkler, *loc. cit.* vol. iv. (1876), p. 7, pl. i. figs. 5, 6. *Odontaspis mourloni*, T. C. Winkler, *loc. cit.* vol. v. (1880), p. 77, woodc. figs. 1, 2. *Odontaspis minutissimus*, F. Noetling, Sitzungsb. naturf. Freunde Berlin, 1886, p. 16.—Eocene; Belgium and South Carolina. Miocene; Mecklenburg. Lower Tertiary; Egypt. (?) London Clay; Sheppey, England. [Synonymy according to W. Dames, *loc. cit.*]

The following is probably a posterior tooth of *Odontaspis*:—

Oxytes obliqua, C. G. Giebel, Fauna d. Vorwelt, Fische (1847), p. 364.—Upper Eocene; Süldorf, Magdeburg.

Genus **ALOPECIAS**, Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 74.]

Second dorsal fin and the anal very small. Caudal fin extremely elongated, with a pit at its root: no keel on the side of the tail. Teeth equal in both jaws, of moderate size, compressed, triangular and not serrated.

The teeth of this genus are not readily distinguishable from those of *Oxyrhina*; the following species, however, are recognized, though the first two are very doubtful:—

Alopecias acuarius, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 140, pl. ii. figs. 76, 77.—Molasse; Baltringen, Württemberg.

(?) *Alopecias gigas*, J. Probst (in part), *tom. cit.* p. 141, pl. ii. figs. 69–71 (*non* figs. 72–75).—Molasse; Baltringen. [See also *Oxyrhina desorii*, synonymy, p. 383.]

Alopecias hassi, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 75, pl. v. figs. 4 *a-f*.—Upper Eocene (Zone A_1); Samland, Prussia.

Vertebræ from the Rupelian of Boom, near Antwerp, and Brüsterort, N. Germany, have also been assigned to this genus by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 223, pl. xxix. figs. 22, 23. They are further remarked upon by F. Noetling, *tom. cit.* p. 78, pl. x. fig. 3.

Genus **OXYRHINA**, Agassiz.

[Poiss. Foss. vol. iii. 1838, p. 86.]

Second dorsal fin and the anal very small. A pit at the root of the caudal fin, which has the lower lobe much developed; side of the tail with a keel. Teeth large, anteriorly lanceolate, posterolaterally triangular and much compressed, without lateral denticles.

Although only differing from *Lamna* in the prevailing absence of lateral denticles in the teeth, it is convenient, from a palæontological point of view, to retain *Oxyrhina* as a distinct genus; more especially as several forms of these teeth bear specific names identical with those applied to other teeth referable to *Lamna* proper.

Oxyrhina mantelli, Agassiz.

1822. *Squalus zygæna*?, G. A. Mantell, Foss. S. Downs, p. 227, pl. xxxii. figs. 4, 7, 8, 10, 11, 26, 28.

1839. *Oxyrhina*, H. B. Geinitz (*ex* Agassiz), Charact. Schicht. u. Petrefakt. sächs.-böhm. Kreidegeb. p. 12, pl. i. fig. 4 (in part).

1843. *Oxyrhina mantelli*, L. Agassiz, Poiss. Foss. vol. iii. p. 280, pl. xxxiii. figs. 1–5, 7–9 (*non* fig. 6).

1843. *Lamna acuminata*, L. Agassiz, *tom. cit.* p. 292, pl. xxxvii. *a*. fig. 54 (? *non* figs. 55–57).

1845. *Oxyrhina mantelli*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 5, pl. iii. figs. 1, 3, 5, 6 (? figs. 2, 4).

(?) 1849. *Oxyrhina mantelli*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 202, pl. xxvii. fig. 158.

1850. *Oxyrhina mantelli*, F. Dixon, Foss. Sussex, pl. xxx. fig. 24.

1850. *Lamna acuminata*, F. Dixon, *op. cit.* pl. xxx. fig. 19.

1852. *Oxyrhina mantelli*, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. figs. 3, 20.

(?) 1852. *Oxyrhina*, R. Kner, Denkschr. k. Akad. Wiss. Wien, vol. iii. pl. xv. fig. 3.

1856. *Oxyrhina mantelli*, C. E. Fischer, Allg. deutsch. naturh. Zeit. Dresden, n. s. vol. ii. p. 141, pl. ii. fig. 43.

1867. *Oxyrhina mantelli (subinflata)*, H. E. Sauvage, Cat. Poiss. Form. Second. Boulonnais, (Mém. Soc. Acad. Boulogne, vol. ii.) p. 71, pl. iii. fig. 16.

1870. *Oxyrhina mantelli*, F. Roemer, Geol. Oberschlesien, p. 323, pl. xxxvi. figs. 3–5.

1872. *Oxyrhina mantelli*, H. E. Sauvage, Bibl. Ecole Hautes Etudes, vol. v. no. 9, p. 21, figs. 33–35.

1872. *Otodus oxyrhinoides*, H. E. Sauvage, *loc. cit.* p. 24, figs. 39–41, 54–56[1].

1873. *Oxyrhina extenta*, J. Leidy, Ext. Vert. Fauna W. Territ. (Rep. U.S. Geol. Surv. Territ. vol. i. pt. i.), p. 392, pl. xviii. figs. 21–25.

1874. *Oxyrhina mantelli*, St. Zareczny, Sprawozd. Komisyi Fizyjograf. Galicyi, vol. viii. p. (126).

1875. *Oxyrhina mantelli*, H. B. Geinitz, Palæontogr. vol. xx. pt. ii. p. 207, pl. xxxviii. figs. 1–21.

1878. *Oxyrhina mantelli*, St. Zareczny, *loc. cit.* vol. xii. p. (203).

1878. *Oxyrhina mantelli*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 7, woodc. fig. 12.

1888. *Oxyrhina mantelli*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 291.

Type. Detached teeth: British Museum and Strassburg Museum.

Teeth moderately robust; outer coronal face always nearly flat, often with large vertical wrinkles; inner coronal face gently rounded; root short, the branches very divergent, thick, expanded, and abbreviated. Anterior teeth large, triangular, and comparatively broad, the crown only gently curved outwards at the apex; lateral teeth having the root much wider than the main portion of the crown, which thus exhibits a sudden basal expansion behind, and often also in front.

Form. & Loc. Cenomanian and Turonian: S.E. England, N. France, Germany, Bohemia, Galicia, and Russia. Senonian: S.E. England and N. France. Cretaceous: Alabama, Kansas, and Mississippi, U.S.A.[2]

4498, 4520, 4521, 4549, 4550. Five of the type specimens, figured by Agassiz, *tom. cit.* pl. xxxiii. figs. 2, 4, 7–9; Chalk, Lewes. *Mantell Coll.*

4524, 4527, 4539, 4540. Four imperfect teeth, figured by Mantell, *op. cit.* figs. 8, 11, 26, 28; Chalk, Sussex. *Mantell Coll.*

[1] To this "species" also H. E. Sauvage (Bull. Soc. Géol. France, [2] vol. viii. 1880, p. 456) refers *Lamna petrocoriensis*, H. Coquand (Descript. Géol. etc. Départ. Charente, vol. ii. 1860, p. 157).

[2] This species is also recorded from the White Chalk of Manganischlak, Caspian Sea (E. von Eichwald, Geogn.-palæont. Bemerk. Halbinsel Manganischlak, 1871, p. 65).

4490, 4494, 4496, 4499–4517, 4519, 4520, 4523, 4525, 4526, 4528–4534, 4537, 4541–4548, 4551, 4556–4559. One tooth and forty-six dental crowns; Chalk, Sussex.
Mantell Coll.

25759, 25787–89, 25799, 25946 a. One complete, and twelve more or less imperfect teeth, the first figured by Dixon, *op. cit.*; Chalk, Sussex. *Dixon Coll.*

25799, 25767. Three teeth figured by Dixon (*op. cit.* pl. xxx. figs. 16, 19, pl. xxxi. fig. 18) under the name of *Lamna acuminata*, the figure of the second also given by Agassiz (*tom. cit.* pl. xxxvii. *a.* fig. 54); Chalk, Sussex. *Dixon Coll.*

25923 a. Four imperfect associated teeth; Chalk, Sussex.
Dixon Coll.

41344. Five imperfect large teeth; Chalk, Sussex.
Purchased, 1869.

43129. Small lateral tooth; Chalk, Sussex. *Wetherell Coll.*

49958. Large lateral tooth; Chalk, Lewes. *Capron Coll.*

P. 1263–4. Three anterior associated teeth, one showing a faint indication of a denticle; also three detached teeth; Chalk, Sussex. *Egerton Coll.*

P. 1265. Five small dental crowns, probably of this species: Chalk, Sussex. *Egerton Coll.*

P. 5403. Broad tooth, with indications of lateral denticles; Chalk, Sussex. *Presented by P. E. Coombe, Esq.*, 1888.

32346–7, 39434. Group of about fifty-seven naturally associated teeth, with remains of vertebræ: Chalk, Grays, Essex. Thirteen of the teeth are shown, of the natural size, in Pl. XVII. figs. 9–21.
Purchased, 1857, *and Bowerbank Coll.*

20289. Small tooth; Chalk, Greenhithe, Kent. *Purchased*, 1846.

23158 a. Two imperfect teeth: Chalk, Kent. *Purchased*, 1849.

39056. Lateral tooth; Chalk, Kent. *Bowerbank Coll.*

40546. Tooth; Chalk, Kent. *Purchased*, 1867.

43095. Lateral tooth; Chalk, Gravesend, Kent. *Wetherell Coll.*

44585. Two small lateral teeth; Gravesend. *Purchased*, 1873.

44840. Two teeth; English Chalk.
Presented by Benjamin Bright, Esq., 1873.

46964. Imperfect tooth; Lower Chalk, Burham, Kent.
Purchased, 1876.

P. 328. Anterior tooth and lateral tooth: Chalk, Charing, Kent.
Purchased, 1881.

P. 400, P. 403. Seven teeth; Chalk, probably Kent.
Presented by the Earl of Ducie, 1881.

P. 1264. Seven small dental crowns: Chalk, Kent. *Egerton Coll.*

47237. Dental crown associated with four vertebræ, labelled *Otodus*? by Prof. Dr. Carl Hasse; Lower Chalk, Dover.
Gardner Coll.

19331. Tooth associated with large group of vertebræ; Grey Chalk, Dover. *Purchased*, 1846.

47253 a, 47255. Two teeth: Grey Chalk, Dover. *Gardner Coll.*

35160 a. Lateral tooth: Cambridge Greensand, Cambridge.
Purchased, 1859.

P. 1239. Small anterior dental crown: Plänerkalk, Quedlinburg, Prussia. *Egerton Coll.*

P. 2371. Five imperfect small teeth; Plänerkalk, Strehlen, near Dresden. *Enniskillen Coll.*

28542. One small tooth, and three imperfect large teeth; Plänerkalk, Teplitz, Bohemia. *Purchased*, 1853.

P. 357. Large anterior tooth; Teplitz. *Purchased*, 1881.

P. 269. Two anterior teeth: Greensand, Regensburg, Bavaria.
Purchased, 1880.

40502. Small anterior tooth, doubtfully of this species; Greensand, Charmouth, Dorset. *Purchased*, 1867.

32047. Tooth with partially separated lateral denticles, and one dental crown; Upper Greensand, Kilmerton, Somerset.
Purchased, 1857.

P. 365. Broad dental crown, doubtfully of this species; Chloritic Marl, Ventnor, Isle of Wight. *Purchased*, 1880.

The following specimens indicate an unknown species, probably closely allied to *O. mantelli*:—

P. 2304. Three teeth, noticed by the present writer in the Geol. Mag. [3] vol. iii. (1886), p. 216; "Lower Greensand," Amuri Bluff, New Zealand. *By exchange*, 1876.

Oxyrhina subbasalis (Kiprijanoff).

1854. *Otodus subbasalis*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 390, pl. iii. figs. 11–21.

Type. Detached teeth.

Teeth of moderate size, the largest attaining a total height of about 0·034, with a slender elevated crown; coronal faces smooth, rarely with a few vertical wrinkles anteriorly; root short, the branches very divergent. Anterior teeth narrow, cuspidate; postero-lateral teeth much compressed, though comparatively narrow, and often with a faint trace of the separation of a pair of lateral denticles.

Form. & Loc. Cenomanian: Governments of Kursk and Saratov, Russia.

P. 5783. Six teeth; Saratov. *History unknown.*

Oxyrhina angustidens, Reuss.

1845. *Oxyrhina angustidens*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 6, pl. iii. figs. 7–13.

1845. *Oxyrhina acuminata*, A. E. Reuss, *op. cit.* pt. i. p. 7, pl. iii. figs. 17–19, pl. vii. fig. 20.

1845. *Oxyrhina heteromorpha*, A. E. Reuss, *op. cit.* pt. i. p. 7, pl. iii. figs. 14–16.

1846. *Scoliodon priscus*, A. E. Reuss, *op. cit.* pt. ii. p. 100, pl. xxiv. figs. 23, 24, pl. xlii. figs. 10–12.

1856. *Oxyrhina angustidens*, C. E. Fischer, Allg. deutsche Naturh. Zeit. n. s. vol. ii. p. 141, pl. ii. figs. 44, 45.

1856. *Oxyrhina heteromorpha*, C. E. Fischer, *tom. cit.* p. 142, pl. ii. figs. 46–49.

1875. *Oxyrhina angustidens*, H. B. Geinitz, Palæontogr. vol. xx. pt. i. p. 293, pl. lxv. figs. 1–3; pt. ii. p. 207, pl. xxxviii. figs. 22–28.

1878. *Oxyrhina angustidens*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 8, woodc. fig. 13.

Type. Detached teeth.

A very small species, the teeth with narrow crowns, not attaining a greater height than 0·012, and the branches of the root elongated in those near the symphysis.

Form. & Loc. Cenomanian and Turonian: Saxony and Bohemia. Turonian and Senonian: S. England.

28542 a. Four imperfect teeth; Plänerkalk, Teplitz, Bohemia. *Purchased*, 1853.

P. 1275, P. 2362. Two dental crowns: Turonian, Bohemia.
Egerton and Enniskillen Colls.

28374. Five imperfect dental crowns: (?) Turonian, Vienenburg, Prussia. *Purchased*, 1853.

P. 304. Three teeth: Plänerkalk, Plauen, near Dresden.
Transferred from Mus. Practical Geology, 1880.

30541 a. Perfect tooth: Upper Greensand, Warminster.
Purchased, 1856.

49955. Two teeth; Lower Chalk, near Guildford. *Capron Coll.*

P. 5784. Tooth: Grey Chalk, Dover, Kent. *Daniels Coll.*

P. 5785. Three teeth; Chalk, Kent. *Daniels Coll.*

41707 b. Tooth: Chalk, Halling, Kent. *Toulmin Smith Coll.*

P. 2380 a. Tooth: Chalk, Kent. *Enniskillen Coll.*

P. 2381. Tooth: Cherry Hinton, Cambridgeshire. *Enniskillen Coll.*

4531, 4562, 4566, 4568, 4570. Five teeth: Chalk, Sussex.
Mantell Coll.

49948. Two associated teeth; Chalk, Glynde, near Lewes.
Capron Coll.

Oxyrhina macrorhiza, Pictet & Campiche.

1858. *Oxyrhina macrorhiza*, Pictet & Campiche, Foss. Terr. Crét. St. Croix, p. 83, pl. x. figs. 6–18.

1882. *Oxyrhina macrorhiza*, E. Arnaud, Bull. Soc. Géol. France, [3] vol. x. p. 133.

Type. Detached teeth.

Teeth of moderate size, very robust and narrow: crown in the anterior teeth relatively small; the root greatly developed and produced inwards, and its branches diverging at a very acute angle.

Form. & Loc. Albian: Switzerland, France, and England.

P. 10. Two teeth: Gault, Folkestone, Kent. *Gardner Coll.*

35128. Seven teeth: Cambridge Greensand, Cambridge.
Purchased, 1859.

36326. Seven teeth; Cambridge Greensand, Cambridge.
Purchased, 1862.

Oxyrhina crassidens, Dixon.

1843. *Oxyrhina mantelli*, L. Agassiz (*errore*), Poiss. Foss. vol. iii. pl. xxxiii. fig. 6.

1850. *Oxyrhina crassidens*, F. Dixon, Foss. Sussex, p. 367, pl. xxxi. fig. 13.

Type. Detached tooth; British Museum.

Teeth extremely robust and of very large size, sometimes attaining a total height of 0·06. Main portion of the crown narrow with respect to the root, the coronal edges rapidly diverging outwards at the base and usually coarsely crimped; outer coronal face irregularly convex, with few vertical wrinkles; inner face extremely convex and smooth, or with minute basal wrinkles.

Form. & Loc. Senonian: Sussex.

25823. Type specimen; Houghton. *Dixon Coll.*

25786. Two nearly complete anterior teeth and four dental crowns. *Dixon Coll.*

25787. Very small dental crown. *Dixon Coll.*

4577. Dental crown, figured by Agassiz, *loc. cit.*; Lewes. *Mantell Coll.*

49951. Dental crown; Lewes. *Capron Coll.*

49951 a. Base of tooth; Arundel. *Capron Coll.*

Oxyrhina triangularis, Egerton.

1845. *Oxyrhina triangularis*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. i. p. 169, woodcut.

Type. Imperfect teeth; British Museum.

A very small species, founded upon the much compressed broad teeth mentioned below.

Form. & Loc. Upper Cretaceous: Pondicherry, Madras, India.

P. 594. Two dental crowns, one figured *loc. cit.* *Egerton Coll.*

Oxyrhina desorii, Agassiz.

1843. *Oxyrhina desorii*, L. Agassiz, Poiss. Foss. vol. iii. p. 282, pl. xxxvii. figs. 8–13.

1843. *Oxyrhina leptodon*, L. Agassiz, *tom. cit.* p. 282, pl. xxxvii. figs. 3–5 (? pl. xxxiv. figs. 1, 2).

1847. *Oxyrhina desorii*, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. p. 267.

1849. *Oxyrhina desorii*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 44, pl. ii. figs. 7–16.

1849. *Oxyrhina desorii*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 203, pl. xxvii. figs. 169–171.

1849. *Oxyrhina wilsoni*, R. W. Gibbes, *ibid.* p. 203, pl. xxvii. figs. 172, 173.

1852. *Oxyrhina desorii*, P. Gervais, Zool. et Pal. Franç. pl. lxxv. fig. 2.

1854–56. *Oxyrhina wilsonii*, O. G. Costa, Paleont. Regno Napoli, pt. ii. pl. vii. fig. 12.

1854–56. *Oxyrhina desorii*, O. G. Costa, *op. cit.* pt. ii. pl. vii. fig. 13.

(?) 1857. *Oxyrhina desorii*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 315, pl. vi. *a*. figs. 12, 13.

1857. *Lamna lyellii*, G. G. Gemmellaro, *tom. cit.* p. 319, pl. vi. *a*. fig. 17.

1857. *Lamna inæquilateralis*, G. G. Gemmellaro, *tom. cit.* p. 319, pl. vi. *a*. fig. 22.

1861. *Oxyrhina incerta*, G. Michelotti, Miocène Inf. Italie Septentr. (Mém. Soc. Holland. Sci., Haarlem), p. 144, pl. xiv. figs. 10–12.

1861. *Oxyrhina desorii*, G. Michelotti, *op. cit.* p. 145, pl. xiv. figs. 13–15.

1863. *Oxyrhina desori*, K. E. Schafhäutl, Süd-Bay. Leth. Geogn. p. 242, pl. lxii. fig. 7.

1871. *Oxyrhina gracilis*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 11 (woodcut).

1876. *Oxyrhina desorii*, R. Lawley, Nuovi Studi Pesci etc. Colline Toscane, p. 29.

1876. *Lamna lyellii*, R. Lawley, *op. cit.* p. 32.

1877. *Oxyrhina desorii*, A. Locard, Faune Terr. Tert. Moy. Corse, p. 4.

1877. *Oxyrhina desorii*, K. Miller, Das Molassemeer Bodenseegeg. p. 66, pl. iii. fig. 74.

1879. *Oxyrhina desorii*, J. Probst, Württ. Jahresh. vol. xxxv. p. 131, pl. ii. figs. 7–13.

1879. *Alopecias gigas*, J. Probst, *ibid.* p. 141, pl. ii. figs. 72–75 (*non* figs. 69–71).

1881. *Oxyrhina desorii*, R. Lawley, Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, p. 77, pls. 2, 3 (*Oxyrhina*).

1885. *Oxyrhina xiphodon*, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3, p. 50, pl. iii.

Type. Detached teeth.

Anterior teeth narrow, much elevated, and robust: crown much curved inwards, the outer coronal face nearly flat, the inner very convex: root with two elongated branches, diverging at an acute angle. Lateral teeth more compressed, with a shorter root having more divergent branches: crown narrow, the cutting-edges in most cases gradually diverging to the extremities of the base, and the apex rarely reflexed.

The dentition of this species only differs from that of the existing *O. spallanzanii* in the less curvature of the lateral teeth.

Form. & Loc. Upper Eocene: Prussia, Italy, Alabama, and South

Carolina. Miocene: France, Belgium, Switzerland, Germany, Malta, Italy, Sicily, and Corsica[1]. Pliocene: Belgium and Italy.

35604-6, 35611-12. About thirty-five teeth; Eocene, Clarke's Co., Alabama, U.S.A. *Presented by Prof. J. W. Mallet*, 1859.

P. 1261, P. 1262. Sixty teeth; Eocene, Clarke's Co., Alabama. *Egerton Coll.*

P. 2374. Twenty-four teeth; Eocene, Clarke's Co., Alabama. *Enniskillen Coll.*

P. 5786. Four imperfect teeth; Miocene, Bordeaux. *Purchased.*

P. 1260. Lateral tooth; Rupelian Beds, Boom, near Antwerp. *Egerton Coll.*

P. 1258. Six imperfect teeth; Molasse, Soleure, Switzerland. *Egerton Coll.*

P. 2364. Six imperfect teeth; Soleure. *Enniskillen Coll.*

P. 1271, P. 1272. Eight imperfect teeth: Molasse, Otmarsingen, Aargau, Switzerland. *Egerton Coll.*

P. 5787. Two teeth; Molasse, Baltringen, Würtemberg. *Purchased*, 1859.

P. 1259, P. 1274 a. Twelve imperfect teeth; Miocene, Malta. *Egerton Coll.*

P. 4560 a. Seven teeth; Malta. *Enniskillen Coll.*

47026-7. Two anterior teeth; Pliocene, Tuscany. *Purchased*, 1875.

The following teeth probably pertain to species allied to *O. desorii*:—

P. 5573. Complete tooth; Tertiary, Murray River, near Adelaide, South Australia. *Presented by William Evans, Esq.*, 1887.

P. 5299. Narrow complete tooth, possibly of the existing *O. spallanzanii*; Formosa, China. *By exchange.*

[1] Teeth of this species from the Miocene of Victoria are also recorded by F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx. (1867), p. 192.

Oxyrhina vanieri, Rouault.

1858. *Oxyrhina vanieri*, M. Rouault, Comptes Rendus, vol. xlvii. p. 101.
1875. *Oxyrhina vanieri*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. iii. p. 633, pl. xxii. fig. 1.
1882. *Oxyrhina vanieri*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 45.

Type. Detached tooth.

A species attaining a somewhat less size than *O. desorii*, and differing from the latter in the comparative stoutness of the teeth. The two forms, however, appear to be very closely related.

Form. & Loc. Miocene: N.W. France.

P. 5788. Tooth, wanting half the root; St. Juvat, near Dinan, Côtes-du-Nord.

Oxyrhina hastalis, Agassiz.

1752. Figure by A. Scilla, De Corporibus Marinis, pl. iii. fig. 2.
1835. Figure by E. Hitchcock, Geol. Massachussetts, pl. xiii. fig. 37.
1843. *Oxyrhina hastalis*, L. Agassiz, Poiss. Foss. vol. iii. p. 277, pl. xxxiv. (excl. figs. 1, 2, ?14).
1843. *Oxyrhina xiphodon*, L. Agassiz, *tom. cit.* p. 278, pl. xxxiii. figs. 11–17.
1843. *Oxyrhina trigonodon*, L. Agassiz, *tom. cit.* p. 279, pl. xxxvii. figs. 17, 18[1].
1843. *Oxyrhina plicatilis*, L. Agassiz, *tom. cit.* p. 279, pl. xxxvii. figs. 14, 15.
1843. *Oxyrhina retroflexa*, L. Agassiz, *tom. cit.* p. 281, pl. xxxiii. fig. 10.
1843. *Oxyrhina quadrans*, L. Agassiz, *tom. cit.* p. 281, pl. xxxvii. figs. 1, 2.
1849. *Oxyrhina hastalis*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 40, pl. i. figs. 41–47.
1849. *Oxyrhina plicatilis*, E. Sismonda, *tom. cit.* p. 42, pl. i. figs. 48–50.
1849. *Oxyrhina xiphodon*, E. Sismonda, *tom. cit.* p. 42, pl. i. figs. 51, 52.
1849. *Oxyrhina isocelis*, E. Sismonda, *tom. cit.* p. 43, pl. ii. figs. 1–6.
1849. *Oxyrhina hastalis*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 201, pl. xxvi. figs. 148–152.
1849. *Oxyrhina xiphodon*, R. W. Gibbes, *tom. cit.* p. 201, pl. xxvii. figs. 153, 154.
1849. *Oxyrhina plicatilis*, R. W. Gibbes, *tom. cit.* p. 202, pl. xxvii. figs. 155–157.

[1] Under this name teeth from the Miocene of Victoria are also recorded by F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx (1867) p. 192.

1850. *Oxyrhina leptodon*, O. G. Costa, Paleont. Regno Napoli, pt. i. p. 121, pl. ix. fig. 11.
1850. *Oxyrhina xiphodon*, O. G. Costa, *ibid.* p. 122, pl. ix. fig. 9.
1850. *Oxyrhina hastalis*, O. G. Costa, *ibid.* p. 123, pl. ix. figs. 10, 12.
1852. *Oxyrhina hastalis*, P. Gervais, Zool. et Pal. Franç. pl. lxxv. figs. 1, 7.
1852. *Oxyrhina xiphodon*, P. Gervais, *op. cit.* pl. lxxv. fig. 8.
1852. *Oxyrhina plicatilis*, P. Gervais, *op. cit.* pl. lxxv. fig. 9.
1854–56. *Oxyrhina plicatilis*, O. G. Costa, Paleont. Regno Napoli, pt. ii. p. 78, pl. vi. fig. 5.
(?) 1854–56. *Oxyrhina desorii*, O. G. Costa, *ibid.* p. 79, pl. vi. fig. 7, pl. vii. figs. 1–3.
1854–56. *Oxyrhina hastalis*, O. G. Costa, *ibid.* pl. vi. figs. 6, 9, 10, 14, pl. vii. fig. 7.
1854–56. *Oxyrhina xiphodon* and *O. leptodon*, O. G. Costa, *ibid.* pl. vii. figs. 5, 6.
1857. *Oxyrhina hastalis*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 312, pl. vi. *a*. fig. 5 *a*.
1857. *Oxyrhina xiphodon*, G. G. Gemmellaro, *tom. cit.* p. 313, pl. vi. *a*. figs. 6 *a*–8 *a*.
1857. *Oxyrhina leptodon*, G. G. Gemmellaro, *tom. cit.* p. 314, pl. vi. *a*. figs. 9 *a* 11 *a*.
1871. *Oxyrhina trigonodon* = *O. plicatilis*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 6.
1875. *Oxyrhina xiphodon*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. iii. p. 633.
1875. *Oxyrhina hastalis*, H. E. Sauvage, *tom. cit.* p. 633.
1876. *Oxyrhina hastalis*, *xiphodon*, *trigonodon*, *plicatilis*, and *isocelia*, R. Lawley, Nuovi Studi Pesci etc. Colline Toscane, pp. 27, 28, 31 (briefly noticed separately).
1877. *Oxyrhina agassizii*, R. Lawley, Atti Soc. Tosc. vol. iii. p. 337.
1877. *Oxyrhina hastalis*, K. Miller, Molassemeer Bodensegeg. p. 65, pl. iii. fig. 73.
1877. *Oxyrhina hastalis*, A. Locard, Faune Terr. Tert. Moy. Corse, p. 2.
1879. *Oxyrhina hastalis*, J. Probst, Württ. Jahresh. vol. xxxv. p. 129, pl. ii. figs. 1–6.
1879. *Oxyrhina xiphodon*, J. Probst, *tom. cit.* p. 132, pl. ii. figs. 14–19.
1881. *Oxyrhina agassizii*, R. Lawley, Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, p. 93, pls. v.–ix. (*Oxyrhina*).
1882. *Oxyrhina xiphodon*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 46.
1882. *Oxyrhina hastalis*, H. E. Sauvage, *tom. cit.* p. 47.
(?) 1888. *Oxyrhina acuminata*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 29, pl. v. fig. 21.

Type. Detached teeth; Stuttgart Museum.

Teeth attaining a large size, broad, thin, compressed; outer

coronal face flat or concave, rarely with vertical wrinkles; root short, the branches very divergent, usually blunt and abbreviated. Anterior teeth large, triangular and relatively broad, the crown only gently curved outwards at the apex; coronal edges of the lateral teeth gradually curving to the extremities of the base, the apex often bent slightly outwards[1].

Lawley has described 150 teeth of this species, found associated with cartilage and vertebræ in the Pliocene of Tuscany; and the synonymy given above is based upon the information thus obtained. It is almost impossible to distinguish many of the postero-lateral teeth from those of *O. desorii* and *O. spallanzanii*.

Form. & Loc. Eocene: Alabama and S. Carolina, U.S.A. Miocene: France, Belgium, Spain, Portugal, Switzerland, Würtemberg, Malta, Italy, Sicily, Corsica, Virginia, Maryland, S. Carolina, and Victoria. Pliocene: S.E. England, Belgium, S. France, and Italy. Oamaru System: New Zealand. Tertiary: Canary and Cape de Verde Isles.

P. 1262 a. Seven small teeth; Eocene, Clarke's Co., Alabama, U.S.A. *Egerton Coll.*

P. 2368. Three teeth; Alabama. *Enniskillen Coll.*

28103. Two small dental crowns; Eocene, South Carolina, U.S.A. *Purchased*, 1852.

P. 5739. Three dental crowns; South Carolina. *Presented by Miss Caroline Birley*, 1888.

P. 5914. Three imperfect teeth; Lower Tertiary, Las Palmas, Canary Isles. *Presented by Sir Charles Lyell, Bart.*

P. 5789. Two imperfect teeth; Lower Tertiary, San Nicatao, Cape de Verde Isles. *Transferred from Mus. Practical Geology*, 1880.

P. 1260 a. Small dental crown; Rupelian Beds, Boom, near Antwerp. *Egerton Coll.*

28369. Tooth; Miocene, (?) Dax, Bordeaux. *Purchased*, 1853.

[1] Some rare teeth, (one from the "Calcaire de Veteuil"), agreeing in every respect with this description, but characterized by the presence of a rudimentary lateral denticle, are named *Otodus apiculatus*, L. Agassiz, *loc. cit.* p. 275, pl. xxxii. figs. 32-35. A rudimentary denticle has already been noted in *O. mantelli* (p. 378, No. P. 1263), thus suggesting that *Otodus apiculatus* is a synonym of *Oxyrhina hastalis*.

32562. Two teeth ; Miocene, Lot-et-Garonne, France.
Purchased, 1857.

32737. Small tooth ; Miocene, Xabregas, Lisbon.
Presented by J. S. Valentine, Esq., 1857.

38645. Dental crown ; Miocene, Tejares, Malaga, Spain.
Purchased, 1860.

P. 1258 a. Two imperfect teeth ; Molasse, Soleure, Switzerland.
Egerton Coll.

P. 1274 b, P. 2363. Three posterior teeth, one figured by Agassiz (*tom. cit.* pl. xxxvii. fig. 2) under the name of *O. quadrans*, Ag. ; Soleure. *Egerton & Enniskillen Colls.*

P. 2365. Two teeth ; Molasse, Otmarsingen. *Enniskillen Coll.*

P. 5790. Three teeth ; Molasse, Baltringen, Wurtemberg.
Purchased, 1859.

24601. Seventeen teeth, some comparatively narrow and referable to the anterior portion of the lower jaw ; Miocene, Malta.
Purchased, 1850.

32582. Two teeth ; Malta. *Purchased*, 1857, 1870.

50011 a. Tooth ; Malta. *Trevelyan Bequest.*

P. 1268, P. 1270, P. 1273–4. Twenty-one teeth, some of the form named *O. quadrans*, Ag. ; Malta. *Egerton Coll.*

P. 2367, P. 2369, P. 4560. Seventeen teeth ; Malta.
Enniskillen Coll.

33315. Twelve large teeth ; Red Crag, Saxmundham, Suffolk.
Purchased, 1858.

30895–7. Nine large teeth ; Red Crag, Woodbridge, Suffolk.
Purchased, 1856.

P. 1269, P. 5154. Twelve teeth ; Red Crag, Suffolk. *Egerton Coll.*

P. 5577. Three teeth, with perforations in the base ; Red Crag, Suffolk. *Harford Coll.*

40398. Two small dental crowns ; Coralline Crag, Gedgrave, Suffolk.
Daniels Coll.

P. 266. Tooth ; Coralline Crag, Orford, Suffolk. *Purchased*, 1880.

41337, 41340. Two teeth; Miocene, Maryland, U.S.A. *Purchased*, 1869.

41911. Two teeth: Crag, Suffolk. *Purchased*, 1870.

42853. Six teeth; Crag, Antwerp. *Van Breda Coll.*

P. 2366, P. 2391. Twelve teeth; Crag, Antwerp. *Enniskillen Coll.*

P. 293. Four imperfect teeth; Pliocene, Montpellier, S. France. *Transferred from Mus. Practical Geology*, 1880.

47023–4. Lateral tooth, and one probably from the symphysis of the lower jaw of this species; Pliocene, Tuscany. *Purchased*, 1875.

1083 (Sloane Cat.). Tooth; locality unknown. *Sloane Coll.*

43995. Four large teeth, provisionally assigned to this species: Miocene, Mordialloc, Melbourne. *Purchased*, 1872.

Oxyrhina crassa, Agassiz.

1843. *Oxyrhina crassa*, L. Agassiz, Poiss. Foss. vol. iii. p. 283, pl. xxxvii. fig. 16 (*non* pl. xxxiv. fig. 14).

(?) 1849. *Oxyrhina crassa*, R. W. Gibbes, Journ. Acad. Nat. S. i. Philad. [2] vol. i. p. 202, pl. xxvii. figs. 159, 160.

1857. *Oxyrhina crassa*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 317, pl. i. *a*. fig. 11*a*.

1871. *Oxyrhina lawleni*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 6, woodcut.

1876. *Oxyrhina crassa*, R. Lawley, Nuovi Studi Pesci etc. Colline Toscane, p. 30.

1876. *Oxyrhina gibbosissima*, R. Lawley, *op. cit.* p. 31.

1876. *Oxyrhina forestii*, R. Lawley, *op. cit.* p. 31.

1881. *Oxyrhina forestii*, R. Lawley, Studi Comp. Pesci foss. coi viv generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, p. 107, pl. iv. (*Oxyrhina*), fig. 1.

1881. *Oxyrhina quadrans*, R. Lawley, *op. cit.* p. 112, pl. iv. (*Oxyrhina*), fig. 2.

1881. *Oxyrhina forestii*, R. Lawley, *op. cit.* p. 121, pl. iv. (*Oxyrhina*), fig. 3.

1881. *Oxyrhina gibbosissima*, R. Lawley, *op. cit.* p. 118, pl. iv. (*Oxyrhina*), fig. 4.

Type. Detached tooth.

A large species, the teeth extremely robust. Anterior teeth narrow, with high crown, and deep root divided into two long

branches diverging at an acute angle; lateral teeth only differing from those of *O. xiphodon* in their considerable thickness.

Form. & Loc. Eocene: S. Carolina and Alabama. Eocene or Miocene: Valley of the Rhine. Miocene: Sicily. Pliocene: Italy and Belgium.

P. 2374. Anterior tooth; Eocene, Clarke's Co., Alabama, U.S.A. *Enniskillen Coll.*

P. 4096. Similar tooth; Phosphate Beds, Charleston, South Carolina, U.S.A. *By exchange*, 1883.

47024 a. Imperfect lateral tooth; Pliocene, Orciano, Tuscany. *Purchased*, 1875.

The following species have also been founded upon teeth, mostly detached; but there are no examples in the Collection:—

Oxyrhina agassizii: *Anotodus agassizii*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. (1871), p. 8, figs.—Pliocene; Belgium.

Oxyrhina brevis, O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 82, pl. vii. figs. 8, 9. *Oxyrhina tumidula*, O. G. Costa, *op. cit.* pt. ii. p. 82, pl. vii. figs. 10, 11.—Miocene; Naples.

Oxyrhina complanata, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. (1849), p. 41, pl. i. figs. 37–40.—Miocene; Piedmont.

Oxyrhina enysii, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. (1888), p. 28, pl. v. figs. 17–20.—Oamaru System; New Zealand. [?=*O. haastii*, Davis.]

Oxyrhina exigua, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 135, pl. ii. figs. 20–25.—Molasse; Baltringen, Württemberg.

Oxyrhina fastigiata, J. W. Davis, *tom. cit.* p. 30, pl. vi. figs. 1–3.—Oamaru System; New Zealand.

Oxyrhina grandis, J. W. Davis, *tom. cit.* p. 30, pl. v. figs. 15, 16.—Oamaru and Waipara Systems, and Cretaceo-Tertiary; New Zealand.

Oxyrhina haastii: *Oxyrhina von haastii*, J. W. Davis, *tom. cit.* p. 26, pl. iv. figs. 1–3.—Oamaru System; New Zealand.

Oxyrhina koehi, T. C. Winkler, Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. (1875), p. 105, pl. ii. figs. 3, 4.—Miocene; Holstein.

Oxyrhina lavigata, A. Daineries, Ann. Soc. Roy. Malacol. Belg., Proc.-verb. 1888, p. liv (name only).—Heersian Beds; Belgium.

Oxyrhina lata, J. W. Davis, *loc. cit.* p. 32, pl. vi. fig. 5.—Oamaru System; New Zealand.

Oxyrhina minuta, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 285, pl. xxxvi. figs. 39–47; E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. (1849), p. 44, pl. ii. figs. 36–39; O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 85, pl. vii. figs. 52–58; G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. (1857), p. 316, pl. vi. *a*. fig. 14.—Lower Miocene; Osnabrück, Prussia; also Piedmont, Naples, and Sicily [1].

Oxyrhina acca, T. C. Winkler, Archiv. Mus. Teyler. vol. iv. (1876), p. 22, pl. ii. fig. 8.—Bruxellian Beds; Woluwe St. Lambert, Brussels.

Oxyrhina aumida, A. Valenciennes, Ann. Sci. Nat. [3] vol. i. (1844), p. 103, pl. i. fig. 15.—Newer Tertiary; Algeria.

Oxyrhina plana, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 274; R. Lawley, Studi Comp. Pesci foss. coi viv. (1881), p. 82.—Tertiary; Ocoya Creek, California.

Oxyrhina recta, J. W. Davis, *loc. cit.* p. 27, pl. v. fig. 14.—Oamaru System: Canterbury, New Zealand.

Oxyrhina rouillieri, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1854, pt. ii. p. 391, pl. iii. figs. 22–26.—Cenomanian; Government of Kursk, Russia.

Oxyrhina sillimani, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. 1847, p. 248, and Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 202, pl. xxvii. figs. 165–168.—Eocene; South Carolina.

(?) *Oxyrhina subinflata*, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 284, pl. xxxvii. figs. 6, 7; P. Gervais, Zool. et Pal. Franc. (1852), pl. lxxvi. fig. 1; H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. no. 9 (1872), p. 22, figs. 36–38.—Albian: Perte-du-Rhône, France. Cenomanian; Kemmertingen, Würtemberg, and Sarthe, France.

Oxyrhina subulata, J. W. Davis, *loc. cit.* p. 31, pl. vi. fig. 4.—Oamaru System: Hog's Back, New Zealand. [?= *O. haastii*, Davis.]

Oxyrhina tarsti, M. Rouault, Comptes Rendus, vol. xlvii. (1858), p. 101.—Miocene; W. France.

Oxyrhina tumula, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 275; R. Lawley, Studi Comp. Pesci foss. coi viv. (1881), p. 82.—Tertiary; Ocoya Creek, California.

[1] Some doubtful teeth from the Eocene of South Carolina are also assigned to this species by R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1849), p. 202, pl. xxvii. figs. 163–164. The last seems referable to *Aprionodon*.

Oxyrhina winkleri, G. Vincent, Ann. Soc. Roy. Malacol. Belg. vol. xi. (1876), p. 125, pl. vi. fig. 3.—Lower Landenian; Belgium.

Oxyrhina woodsii, J. E. T. Woods (*ex* F. M'Coy, MS.), Geol. Obs. S. Australia (1862), p. 80, woodcut.—Tertiary; Mt. Gambier.

Oxyrhina zignoi, F. Bassani, Atti Soc. Tosc. Sci. Nat. vol. iii. (1877), p. 78, pl. xi. fig. 2; Atti Soc. Veneto-Trent. Sci. Nat. vol. v. (1878) p. 280.—Eocene; Fumane, Verona.

(?) *Oxyrhina zippei*, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 284, pl. xxxvi. figs. 48–52.—Cenomanian; Regensburg, Bavaria[1]. [The original of fig. 48 is considered to be the lateral denticle of a large tooth of "*Otodus*" by H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. no. 9, p. 23.]

Teeth of the recent *Oxyrhina gomphodon*, Müller & Henle (= *O. spallanzanii*, Bonaparte), are also recorded from a Tertiary deposit in the island of Bonaire, West Indies, by K. Martin, Zeitschr. deutsch. geol. Ges. vol. xxxi. (1879), p. 477.

Vertebræ of *Oxyrhina* are also described by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), from the Chalk of Orel, Russia (*op. cit.* p. 234, pl. xxxi. fig. 47), and from the Tertiaries of Baltringen, Flonheim, and Antwerp (*op. cit.* p. 234, pl. xxxi. figs. 43–46). Others by F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 57, pl. x. fig. 5.

The so-called *Oxyrhina arnaudi*, H. Coquand (Descript. Géol. etc. Départ. Charente, vol. ii. 1860, p. 133), from the Santonian Beds of France, is considered by H. E. Sauvage to be probably founded upon a tooth of *Corax* (Bull. Soc. Géol. France, [3] vol. viii. 1880, p. 456).

Genus **LAMNA**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 126.]

Syn. *Otodus*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 266.

Second dorsal fin and the anal very small. A pit at the root of the caudal fin, which has the lower lobe much developed; side of the tail with a keel. Dentition only differing from that of *Odontaspis* (p. 360) in the relatively less elevated and less subulate character of the anterior teeth, and the usually larger size of the lateral denticles.

By *Oxyrhina mantelli* this genus appears to be connected with *Oxyrhina*; by *Lamna obliqua* with *Carcharodon*.

[1] Some doubtful Tertiary teeth are also assigned to this species by O. G. Costa, Paleont. Regno Napoli, pt. i. (1850), p. 121, pl. ix. figs. 8, 19.

Lamna appendiculata (Agassiz).

1799. *Dent de Squale*, Faujas St.-Fond, Hist. Nat. Mt. St.-Pierre de Maestricht, p. 110, pl. xviii. fig. 2.

1822. *Squalus mustelus?*, G. A. Mantell, Foss. S. Downs, pl. xxxii. figs. 2, 3, 5, 6, 9.

1839. *Squalus cornubicus* and *Odontaspis rhaphiodon*, H. B. Geinitz, Charact. Schicht. u. Petrefakt. böhm.-sächs. Kreideform. pp. 11, 12, pl. i. figs. 3, 5.

1841. *Otodus appendiculatus*, F. Roemer (ex Agassiz, MS.), Nordd. Kreidegeb. p. 107.

1843. *Otodus appendiculatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 270, pl. xxxii. figs. 1–25.

1845. *Otodus appendiculatus*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 5, pl. iii. figs. 23–29 (? figs. 30, 31, *non* fig. 22).

(?) 1847. *Otodus basalis*, C. G. Giebel, Fauna d. Vorw., Fische, p. 354.

1849. *Otodus appendiculatus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 199, pl. xxvi. figs. 138–140.

1850. *Otodus appendiculatus*, F. Dixon, Foss. Sussex, pl. xxx. fig. 25, pl. xxxi. fig. 17.

1852. *Otodus latus?*, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. fig. 23.

(?) 1852. *Lamna acuminata*, P. Gervais, *op. cit.* pl. lxxvi. figs. 12, 24.

(?) 1854. *Otodus basalis*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 388, pl. ii. figs. 31–38, pl. iii. figs. 1–10.

1855. *Otodus appendiculatus*, L. Hebert, Mém. Soc. Géol. France, 2 vol. v. p. 355.

1856. *Otodus appendiculatus*, C. E. Fischer, Allg. deutsche Naturh. Zeit. n. s. vol. ii. p. 141, pl. ii. figs. 38–4 fig. 59).

1858. *Otodus appendiculatus*, Pictet & Campiche, Foss. Terr. Crétacé St. Croix, p. 82, pl. x. figs. 3, 4.

1870. *Otodus appendiculatus*, F. Roemer, Geol. von Oberschlesien, p. 323, pl. xxxvi. fig. 6.

1872. *Otodus appendiculatus*, H. E. Sauvage, Bibl. Ecole Hautes Etudes, vol. v. no. 9, p. 26, pl. ii. figs. 57–59.

1872. *Lamna acuminata*, H. E. Sauvage, *ibid.* p. 34, pl. ii. figs. 73–75.

1875. *Otodus appendiculatus*, H. B. Geinitz, Palæontogr. vol. xx. pt. i. p. 294, pl. lxv. figs. 6, 7, pt. ii. p. 208, pl. xxxviii. figs. 37–54.

1874. *Otodus appendiculatus*, St. Zareczny, Sprawozd. Komisyi Fizyjograf. Galicyi, vol. viii. p. (125).

1878. *Otodus appendiculatus*, St. Zareczny, *loc. cit.* vol. xii. p. (203).

1888. *Otodus appendiculatus*, R. Etheridge, jun., Proc. Linn. Soc. N. S. Wales, [2] vol. iii. p. 158, pl. iv. fig. 1.

1888. *Otodus appendiculatus*, S. Nikitin, Mém. Comité Géol. vol. v. no. 2, p. 40, pl. v. figs. 3–5.

Type. Detached teeth; British Museum and Strassburg Museum.

Teeth robust, with a very thick root having a much flattened postero-inferior face, the nutritive foramen not in a groove: the largest example attaining a total height of about 0·04. Outer

coronal face slightly convex or flat, often with few indefinite vertical folds in the basal half; inner coronal face markedly convex, smooth; cutting-edges prominent; a single pair of lateral denticles, broad but pointed. Anterior teeth narrow and upright: lateral teeth much inclined backwards, the anterior edge being much more arcuate and longer than the posterior.

Form. & Loc. Albian—Senonian: S. England. Cenomanian: Belgium, Bavaria, and Russia. Cenomanian and Turonian: Saxony, Upper Silesia, and Bohemia. (?) Danian: Holland. Upper Cretaceous: Galicia, New Jersey, and N. Queensland [1].

35885, 36114, 36319, 36320, 36905. Seven teeth, including one very robust example, 0·04 in total height; Gault, Folkestone. *Purchased*, 1861, 1862.

36331. Tooth; Gault, Folkestone. *Daniels Coll.*

47218 a, P. 9. Fifteen teeth: Gault, Folkestone. *Gardner Coll.*

P. 253–4. Three teeth; Gault, Folkestone.
Presented by J. Wood-Mason, Esq., 1880.

P. 2382. Anterior tooth figured by Agassiz, *tom. cit.* pl. xxxii. fig. 7; Gault, Folkestone. *Enniskillen Coll.*

28108. Seventeen teeth; Cambridge Greensand, Cambridge.
Presented by James Carter, Esq., 1852.

35127, 35129, 35160. Thirty-four teeth; Cambridge Greensand.
Purchased, 1859.

41914. Nine teeth; Cambridge Greensand. *Purchased*, 1870.

P. 5791. Three teeth; Cambridge Greensand.

40501. Lateral tooth; Upper Greensand, Charmouth, Dorset.
Purchased, 1867.

47957. Tooth; Upper Greensand, Warminster.
Presented by the Hon. Robert Marsham, 1877.

P. 5793. Six imperfect teeth, and one with a remarkably broad triangular compressed crown; Warminster.

P. 5909. One perfect and one imperfect tooth; Greensand, Tournai, Belgium. *Purchased.*

P. 1283. Seven teeth, more or less imperfect; Tournai.
Egerton Coll.

[1] This species is also recorded from the White Chalk of Manganischlak (E. von Eichwald, Geogn.-palæont. Bemerk. Halbinsel Manganischlak, 1871, p. 65).

P. 5792. Imperfect anterior tooth ; Tournai. *Enniskillen Coll.*

P. 268. Three teeth ; Greensand, Regensburg, Bavaria.
Purchased, 1880.

P. 5558. Fourteen teeth ; Cenomanian, Saratov, Russia.
By exchange, 1888.

23158. Tooth ; Chalk Marl, Dover. *Purchased*, 1849.

P. 2299. Two teeth ; Chalk Marl, Rocken End, Undercliff, Isle of Wight. *Presented by Mrs. Burton*, 1882.

1505. Tooth ; Plänerkalk, Weinböhla, near Meissen, Saxony.
Purchased, 1838.

28893. Four teeth : Plänerkalk, Strehlen, near Dresden, Saxony.
Dixon Coll.

P. 283, P. 301. Eight teeth : Plänerkalk, Strehlen.
Transferred from Mus. Practical Geology, 1880.

P. 1281. Eight teeth : Plänerkalk, Strehlen. *Egerton Coll.*

49195. Three teeth : Grey Chalk, Dover. *Daniels Coll.*

36904, 43011. Three teeth : Grey Chalk, Dover.
Purchased, 1862, 1871.

47244, 47253, 47256–7. Twelve teeth ; Grey Chalk, Dover.
Gardner Coll.

P. 45. Group of about sixty naturally associated teeth, including some from the symphysial region and many of the hindermost teeth ; Lower Chalk, Dover. *Gardner Coll.*

49948. Four teeth, one very large though fragmentary ; Lower Chalk, Guildford, Surrey. *Capron Coll.*

4475, 4486. Five teeth, figured by Agassiz, *tom. cit.* pl. xxxii. figs. 1, 5, 6, 11, 14 ; Chalk, Sussex. *Mantell Coll.*

4518. Tooth figured in Mantell's Foss. South Downs, pl. xxxii. fig. 6 ; Chalk, Sussex. *Mantell Coll.*

4473, 4476, 4477, 4480, 4483, 4484, 4485, 4487, 4488, 4491, 4493, 4564, 4565, 4567, 4572. About twenty teeth ; Chalk, Sussex. *Mantell Coll.*

25799, 25762. Two teeth figured by Dixon, *op. cit.* pl. xxx. fig. 25, pl. xxxi. fig. 17 ; Chalk, Sussex. *Dixon Coll.*

25799, 25800, 25946 b. Twelve teeth ; Chalk, Sussex. *Dixon Coll.*

49949. Tooth ; Chalk, Arundel, Sussex. *Capron Coll.*

49950. Tooth ; Chalk, Lewes. *Capron Coll.*

49898. Group of fifteen vertebræ and fifteen teeth ; Chalk, Glynde, Lewes. *Capron Coll.*

P. 1280. Four teeth ; Chalk, Sussex. *Egerton Coll.*

P. 5401. Tooth ; Chalk, Lewes.
Presented by P. E. Coombe, Esq., 1888.

P. 1280 a. Imperfect tooth ; Chalk, Heytesbury, Wiltshire.
Egerton Coll.

20289. Tooth and dental crown ; Chalk, Greenhithe, Kent.
Purchased, 1846.

23158. Tooth ; Chalk, Kent. *Purchased*, 1849.

39053. Group of about twenty-five naturally associated teeth in a block of Chalk from the neighbourhood of Maidstone, Kent. Most of the teeth belong to the anterior portion of the jaw and are very robust. One tooth much resembles the original of fig. 7 of Agassiz's pl. xxxii. *tom. cit.* ; and a small example may most probably be regarded as the diminutive third tooth of the upper jaw, closely resembling a tooth assigned to *Lamna subulata* by H. B. Geinitz, Palæontogr. vol. xx. pt. ii. pl. xxxviii. fig. 31.
Bowerbank Coll.

41707. Two small teeth ; Chalk, Burham, Kent.
Toulmin Smith Coll.

44212–3. Four teeth ; Upper Chalk, Purley, Kent.
Purchased, 1873.

47920. Four associated and two detached teeth ; Chalk, near Maidstone. *Presented by the Hon. Robert Marsham*, 1877.

P. 1280 b. Fine lateral tooth and one small hinder tooth ; Chalk, Kent. *Egerton Coll.*

P. 401. Five teeth, probably from the Chalk of Kent.
Presented by the Earl of Ducie, 1881.

44031. Small tooth ; Upper Chalk, Bromley, Kent.
Purchased, 1873.

P. 4100 a. Tooth ; Chalk, Birchington, near Margate, Kent.
Presented by Sydney C. Cockerell, Esq., 1883.

49947. Seven teeth, including one of the supposed third upper series; Upper Chalk, Guildford, Surrey. *Capron Coll.*

35652. Tooth; Upper Chalk, Norwich. *Bayfield Coll.*

48956 a. Tooth; Upper Chalk, Norwich. *Bayfield Coll.*

P. 2357. Three teeth, probably of this species; Upper Cretaceous, Maastricht, Holland. *Enniskillen Coll.*

42868. Nine teeth, mostly imperfect; Upper Cretaceous, Obourg, Hainaut, Belgium. *Van Breda Coll.*

Lamna lata (Agassiz).

1843. *Otodus latus*, L. Agassiz, Poiss. Foss. vol. iii. p. 271, pl. xxxii. fig. 26.

Type. Detached tooth.

Teeth broad, much compressed, the inner coronal face smooth; a single pair of extremely broad, acuminate lateral denticles.

Form. & *Loc.* Danian: Holland. Upper Senonian: Syria.

P. 1284. Typical tooth, labelled by Agassiz, and noticed. *loc. cit*; Maastricht, Holland. *Egerton Coll.*

P. 4535. Smaller tooth; Sahel Alma, Mt. Lebanon, Syria. *Enniskillen Coll.*

Lamna semiplicata (Agassiz).

1843. *Otodus semiplicatus*, L. Agassiz (*ex* Münster, MS.), Poiss. Foss. vol. iii. p. 272, pl. xxxvi. fig. 32 (? fig. 33).

1845. *Otodus semiplicatus*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 5, pl. iii. figs. 20, 21.

1872. *Otodus semiplicatus*, H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. no. 9, p. 26, figs. 25, 26.

1875. *Otodus semiplicatus*, H. B. Geinitz, Palæontogr. vol. xx. pt. ii. p. 209, pl. xxxviii. figs. 55–60[1].

1878. *Otodus semiplicatus*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 7, woodc. fig. 10.

1882. *Otodus semiplicatus*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 292.

Type. Imperfect tooth; Munich Museum.

Teeth robust, of considerable size, with a single pair of very broad lateral denticles, sometimes incompletely subdivided. Outer coronal face even, flat or slightly convex; a series of short parallel vertical wrinkles upon the basal portion of the crown both on the outer and inner face. Root with a considerable inward prominence immediately below the base of the crown.

[1] The originals of figs. 59 and 60 much resemble the supposed young teeth of *L. subulata*.

Form. & *Loc.* Cenomanian: N.W. France. Turonian: Saxony, Bohemia, and S.E. England [1].

43514. Nearly perfect tooth, noticed by the present writer, *loc. cit.*: Rochester, Kent. *Purchased*, 1872.

P. 327. More posterior tooth; Charing, Kent. *Harris Coll.*

Lamna sulcata (Geinitz).

1843. *Otodus sulcatus*, H. B. Geinitz, Char. Schicht. u. Petrefakt. sächs.-böhm. Kreidegeb. Nachtr. p. 5, pl. iv. fig. 2.

1845. *Otodus appendiculatus*, A. E. Reuss (*non* Agassiz), Verstein. böhm. Kreideform. pl. iii. fig. 22.

1846. *Otodus sulcatus*, A. E. Reuss, *op. cit.* pt. ii. p. 100, pl. xxi. fig. 41.

1852. *Otodus?*, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. fig. 11.

(?) 1852. *Otodus appendiculatus*, R. Kner, Denkschr. k. Akad. Wiss. Wien, vol. iii. pl. xv. fig. 1.

1856. *Otodus sulcatus*, C. E. Fischer, Allg. deutsche Naturh. Zeit. n. s. vol. ii. p. 141, pl. ii. fig. 41.

(?) 1856. *Odontaspis rhaphiodon*, C. E. Fischer, *tom. cit.* p. 142, pl. ii. fig. 51.

1860. *Otodus michoni*, H. Coquand, Descript. Géol. etc. Charente, vol. ii. p. 98 [2].

1872. *Otodus sulcatus*, H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. no. 9. p. 29, figs. 60–69.

1872. *Otodus pinguis*, H. E. Sauvage, *tom. cit.* no. 9, p. 31, figs. 70-72.

1873. *Otodus dicariatus*, J. Leidy, Ext. Vert. Fauna W. Territ. (Rep. U.S. Geol. Surv. vol. i. pt. i.), p. 305, pl. xviii. figs. 26–28.

1875. *Otodus sulcatus*, H. B. Geinitz, Palæontogr. vol. xx. pt. i. p. 294, pl. lxv. figs. 4, 5.

(?) 1880. *Odontaspis rochebrunei*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. viii. p. 457, pl. xiii. fig. 3.

1888. *Otodus crassus*, A. S. Woodward (*non* Agassiz), Proc. Geol. Assoc. vol. x. p. 292.

Type. Detached tooth.

Teeth very robust, the crown sometimes attaining a height of nearly 0·05. Outer coronal face slightly convex, generally uneven; both the inner and the outer face with a more or less prominent series of vertical wrinkles towards the base, usually irregular. A single pair of large acuminate lateral denticles, slightly divergent, often incompletely separated from the principal cone. Root with a considerable inward prominence immediately below the base of the crown.

[1] A nearly perfect tooth from the Upper Cretaceous of Southern India is also compared with this species by F. Stoliczka, Cret. Fauna S. India (Palæont. Ind.) vol. iv. pt. 4 (1873), p. 67, pl. xii. fig. 24.

[2] Referred to this species by H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. viii. (1880), p. 456.

The limits of this species are not readily determinable, but we venture to follow Sauvage (*loc. cit.* 1872) in assigning to it the very large teeth mentioned below. We would further suggest that there are no differences of specific value between the originals of Sauvage's figs. 60, 61, and that of the same author's figs. 70–72; and *Otodus pinguis* is thus relegated to the above synonymy.

Geinitz (*loc. cit.* 1875) considers that the so-called *Hybodus gracilis*, Reuss, and *H. regularis*, Reuss, are founded upon teeth of the young of this species.

Form. & Loc. Cenomanian and Turonian: S.E. England, W. France, Belgium, Saxony, and Bohemia. Senonian: S.E. England. Cretaceous: Texas, and (?) Galicia.

P. 5908. Two imperfect teeth; Greensand, Belgium. *Purchased.*

39054. Large anterior tooth; Chalk, Surrey. *Bowerbank Coll.*

25786. Imperfect tooth; Chalk, Sussex. *Dixon Coll.*

P. 5402. Tooth; Chalk, near Lewes.
Presented by P. E. Coombe, Esq., 1888.

41704. Imperfect tooth; Chalk, near Rochester.
Toulmin Smith Coll.

P. 1288. Imperfect anterior tooth; English Chalk. *Egerton Coll.*

Lamna macrorhiza, Cope.

1875. *Lamna macrorhiza.* E. D. Cope, Vert. Cret. Form. West (Rep. U.S. Geol. Surv. Territ. vol. ii.), p. 297, pl. xlii. figs. 9, 10.

Type. Detached teeth.

Teeth of small size, elevated though robust, the maximum total height being about 0·025. Outer coronal face flat, or nearly so, with a faint median longitudinal elevation, and often a few folds at the base; inner coronal face very convex, smooth; cutting-edges sharp. A single pair of relatively large, narrow, acuminate lateral denticles, divergent, also often marked at the base by minute vertical folds. Root with a prominent inward projection below the base of the crown; nutritive foramen in a groove.

Form. & Loc. Niobrara Formation: Kansas, U.S.A. Albian: S. England. Cenomanian: S.E. Russia.

37398. Small tooth; Gault, Folkestone, Kent. *Purchased*, 1863.

P. 12 a. Two large teeth; Folkestone. *Gardner Coll.*

47218 b, P. 12 b. Ten examples; Folkestone. *Gardner Coll.*

P. 5560. Five teeth; Cenomanian, Saratov, Russia.
By exchange, 1888.

Lamna crassa (Agassiz).

1843. *Otodus crassus*, L. Agassiz, Poiss. Foss. vol. iii. p. 271, pl. xxxvi. figs. 29–31.

1854. *Otodus crassus*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 384, pl. ii. figs. 4–20.

Type. Imperfect teeth.

Teeth robust, the crown attaining a maximum height of about 0·04. Outer coronal face somewhat convex, generally with two or three broad vertical folds; a single pair of broad, acuminate lateral denticles. Root relatively compressed, scarcely forming an inward prominence below the base of the crown.

Form. & Loc. Cenomanian: Bavaria and S.E. Russia. Danian: Belgium [1].

P. 5554. Imperfect tooth; Craie phosphatée, Ciply, near Mons, Belgium. *By exchange*, 1888.

P. 5833. Four teeth, and five dental crowns; Ciply.
Presented by Mons. A. Houzeau de Lehaie, 1888.

The following four teeth seem to indicate a Cretaceous species distinct from any already described. The dental crown is moderately compressed, smooth, high, acute, and narrow; a single pair of large acuminate lateral denticles is present; the root is relatively small.

48956 b. Two teeth, one measuring 0·027 in total height; Upper Chalk, Norwich. *Bayfield Coll.*

P. 1282 a. Tooth with imperfect root; Upper Cretaceous, Maastricht, Holland. *Egerton Coll.*

P. 5832. Tooth; Craie phosphatée, Ciply, near Mons, Belgium.
Presented by Mons. A. Houzeau de Lehaie, 1888.

Lamna serra, sp. nov.

Type. Detached teeth; British Museum.

Teeth of moderate size, the largest attaining a total height of about 0·018; crown elevated, smooth, and much compressed, with

[1] This species is also recorded from the Cretaceous of Alabama by R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1849) p. 200, pl. xxvi. fig. 142.

a single pair of broad acuminate lateral denticles, and one or two smaller outer pairs: root short, the branches diverging at a very wide angle, and the nutritive foramen situated in a groove.

The teeth named *Galeocerdo tremansi*, Sauvage (= *Lamna*, p. 409), seem to approach this species most closely, but are distinguished by the relatively deeper root and the larger size of the lateral denticles. The so-called *Otodus serratus*, Agassiz (Poiss. Foss. vol. iii. 1843, p. 272, pl. xxxii. figs. 27, 28), is founded upon teeth also very similar, but differing in the irregularity of the lateral denticles; these teeth probably pertaining to *Odontaspis hopei*.

Form. & Loc. Danian: Mont Aimé, Marne, France.

P. 5761. Two type specimens. *Purchased*, 1851.

P. 5762. Twenty teeth, mostly imperfect. *Purchased*, 1851.

Lamna divergens (Egerton).

1845. *Otodus divergens*, Sir Philip Egerton, Quart. Journ. Geol. Soc. vol. i. p. 169, woodcut.

Type. Detached tooth; British Museum.

Teeth of very small size, much compressed and elevated; coronal surface smooth. A single pair of large sharply-pointed lateral denticles, somewhat divergent, with a minute outer pair.

Form. & Loc. Upper Cretaceous: Madras, India.

P. 593. Type specimen: Pondicherry. *Egerton Coll.*

Lamna trigonata (Agassiz).

1843. *Otodus trigonatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 274, pl. xxxvi. figs. 35–37.

Type. Imperfect teeth; Munich Museum.

Teeth small, broad, much compressed, with smooth coronal faces; a single pair of large, broad, acuminate, lateral denticles. Root short and comparatively robust.

Form. & Loc. Upper Eocene (Ironstone): Kressenberg, Bavaria [1].

P. 1289. Two teeth. *Egerton Coll.*

P. 5794. Hinder tooth. *Enniskillen Coll.*

[1] Doubtful teeth from the Eocene of South Carolina are also assigned to this species by R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1849), p. 200, pl. xxvi. figs. 145, 146.

Lamna macrota (Agassiz).

1843. *Otodus macrotus*, L. Agassiz, Poiss. Foss. vol. iii. p. 273, pl. xxxii. figs. 29–31.

1843. *Lamna elegans*, L. Agassiz (in part), *tom. cit.* pl. xxxv. figs. 6, 7, pl. xxxvii. *a*. fig. 58.

1843. *Lamna compressa*, L. Agassiz, *tom. cit.* p. 290, pl. xxxvii. *a*. figs. 35–42.

1849. *Otodus macrotus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 200, pl. xxvi. figs. 143, 144.

1850. *Otodus lanceolatus*, F. Dixon (*non* Agassiz), Foss. Sussex, p. 204, pl. xi. figs. 20, 21.

1863. *Otodus macrotus*, K. E. Schafhaütl, Süd-Bay. Leth. Geogn. p. 243, pl. lxii. fig. 10.

1875. *Otodus macrotus*, T. C. Winkler, Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. p. 110.

1888. *Lamna marginalis*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 19, pl. iii. figs. 8–10.

Type. Detached teeth; Paris Museum of Natural History.

Teeth much compressed, the largest attaining a maximum total height of about 0·05; cutting-edges prominent; outer coronal face gently convex; inner coronal face with faint longitudinal striæ; a single pair of lateral denticles, well separated, broad, but rarely acuminate.

Form. & Loc. Lower Eocene: S.E. England and South Carolina. Middle Eocene: London and Hampshire Basins, and N. France. Upper Eocene: S. Germany. Lower Miocene: Belgium and W. Germany. Oamaru and Waipara Systems: New Zealand.

P. 5905. Three teeth; London Clay, Sheppey. *Daniels Coll.*

P. 1286. Three teeth; Sheppey. *Egerton Coll.*

P. 5505. Postero-lateral tooth; Lower Eocene, Sydenham, near London. *Caleb Evans Coll.*

23200. Tooth; Bracklesham Beds, Bracklesham Bay, Sussex. *Presented by S. P. Woodward, Esq.*, 1849.

25683 a, 25685–6. Nineteen teeth; Bracklesham Bay. *Dixon Coll.*

40235. Twelve teeth: Bracklesham Bay. *Edwards Coll.*

P. 5795. Five teeth; Bracklesham Bay. *Purchased*, 1882.

39774. Broad tooth; (?) M. Eocene, Hampshire. *Purchased*, 1862.

40309. Anterior tooth; Colesworth, near Woking, Surrey. *Purchased*, 1867.

P. 1287. Eight teeth; Bracklesham Bay. *Egerton Coll.*

P. 2358. Six teeth; Bracklesham Bay. *Enniskillen Coll.*

28851. Five anterior teeth; Calcaire Grossier, Roquet, Paris. *Purchased*, 1854.

28851 a. Sixteen teeth; Roquet. *Purchased*, 1854.

P. 5796. Four fragmentary teeth; Calcaire Grossier, Chaumont, Paris. *Purchased.*

40228, 40243. Ten teeth; Barton Clay, Barton Cliff, Hampshire. *Edwards Coll.*

P. 55 c. Imperfect large tooth; Barton. *Presented by Sir Richard Owen, K.C.B.*, 1880.

P. 1166. Eleven teeth; Barton. *Egerton Coll.*

P. 2359. Four teeth; Barton. *Enniskillen Coll.*

30892. Tooth: Upper Eocene, Bramshaw, Hampshire. *Purchased*, 1856.

40236. Two teeth; Bramshaw. *Edwards Coll.*

P. 1291. Four teeth: Eocene, near Brussels. *Egerton Coll.*

P. 2376. Three teeth: Rupelian Beds, Boom, near Antwerp, Belgium. *Enniskillen Coll.*

9758. Small tooth: Lower Miocene, Cassel. *Mantell Coll.*

28364. Tooth; said to have been obtained from the Miocene of Dax, Bordeaux. *Purchased*, 1854.

Lamna vincenti (Winkler).

1876. *Otodus vincenti*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. p. 25, pl. ii. figs. 9, 10.

Type. Detached teeth.

Teeth much compressed, the largest attaining a maximum total height of about 0·018; apex acute and cutting-edges prominent; outer coronal face gently convex: inner coronal face smooth; a single pair of broad, well-separated, acuminate lateral denticles, flanked in the side teeth by a minute outer pair.

It is possible that some of the type-specimens of *Lamna com-*

pressa, Ag., pertain to this species; but most of the teeth figured by Agassiz may be assigned to *L. macrota*, and we therefore adopt Winkler's name for the specific type now defined.

Form. & Loc. Lower Eocene: S.E. England. Middle and Upper Eocene: Hampshire Basin and Belgium. Lower Miocene: Belgium and France.

43132. Two teeth; London Clay, Highgate. *Wetherell Coll.*

P. 5507. Two teeth; Lower Eocene, Portsmouth, Hampshire. *Caleb Evans Coll.*

25685 b. Two teeth; Bracklesham Beds, Bracklesham Bay, Sussex. *Dixon Coll.*

40243 a. Three teeth; Bracklesham. *Edwards Coll.*

40244 a. Tooth; Barton Clay, Barton Cliff, Hampshire. *Edwards Coll.*

P. 5912. Twelve teeth; Bruxellian Beds, Woluwe St. Lambert, Brussels. *Presented by M. Houzeau de Lehaie*, 1889.

P. 1292. Tooth; Rupelian Beds, Boom, near Antwerp. *Egerton Coll.*

28366 a. Tooth; Faluns of Touraine, France. *Purchased*, 1853.

Lamna (?) obliqua (Agassiz).

1766. *Dens Squali*, G. Brander, Foss. Hantoniensia, pl. ix. fig. 115.

1843. *Otodus obliquus*, L. Agassiz, Poiss. Foss. vol. iii. p. 267, pl. xxxi., pl. xxxvi. figs. 22–27.

1843. *Otodus lanceolatus*, L. Agassiz, *tom. cit.* p. 269, pl. xxxvii. figs. 19–23.

1849. *Otodus obliquus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 199, pl. xxvi. figs. 131–137.

1850. *Otodus obliquus*, F. Dixon, Foss. Sussex, p. 204, pl. x. figs. 32–35, pl. xv. fig. 11.

1883. *Otodus obliquus*, W. Dames, Sitzungsb. k. preuss. Akad. Wiss. pt. i. p. 145, pl. iii. fig. 6.

1883. *Otodus obliquus*, H. B. Geinitz, Abh. naturw. Ges. Isis Dresden, p. 6, pl. i. figs. 12–18.

1885. *Carcharodon obliquus*, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. iii. p. 84, pl. vi. figs. 4–6.

(?) 1888. *Otodus obliquus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 15, pl. vii. fig. 16.

Type. Detached teeth; Museums of Paris and Strassburg.

Teeth robust, attaining to a very large size: crown moderately compressed, sharply pointed, with one broad acuminate pair of lateral denticles, and, in the smaller teeth, an additional pair of more slender denticles. Outer coronal face flat or slightly convex, without folds; inner face smooth.

As pointed out by Noetling (*loc. cit.*) this species may belong to *Carcharodon*; and in very rare instances (*e. g.* No. 43111) the edges of the teeth exhibit faint serrations.

Form. & Loc. Lower Eocene: London Basin. Middle and Upper Eocene: Hampshire Basin, Prussia and Bavaria. Eocene: New Jersey. Lower Tertiary: Egypt.

1425 (Sloane Cat.). Tooth; London Clay, Isle of Sheppey.
Sloane Coll.

28359, 28361. 29013. Seven large teeth, and one small example probably of this species: London Clay, Isle of Sheppey.
Cowderoy Bequest.

24617. 32264. Four large teeth; Sheppey. *Purchased*, 1850.

28886, 28889. Two large teeth and two small lateral teeth: Sheppey.
Daniels Coll.

39773. Abraded tooth, cut longitudinally: Sheppey.
Bowerbank Coll.

40522. Three large teeth: Sheppey. *Purchased*, 1867.

42852. Tooth with blunt lateral denticles: Sheppey.
Van Breda Coll.

44137. Malformed tooth: Sheppey. *Purchased*, 1873.

P. 55. Tooth; (?) Sheppey.
Presented by Sir Richard Owen, K.C.B., 1880.

P. 162. Malformed tooth: Sheppey. *Purchased*, 1880.

P. 439 a. Eight teeth; Sheppey. *Purchased*, 1882.

P. 1277. Five teeth; Sheppey. *Egerton Coll.*

P. 2360–1. P. 2361 a. Two typical teeth, and two malformed; Sheppey. *Enniskillen Coll.*

P. 5798. Twenty-six large teeth: Sheppey. *History unknown.*

P. 5799. Six small teeth; Sheppey. *History unknown.*

43114. Abraded tooth: London Clay, Primrose Hill, London.
Wetherell Coll.

43111. Tooth exhibiting indistinct serrations; London Clay, Highgate, near London. *Wetherell Coll.*

43120. Large tooth; London Clay, Finchley, near London.
Wetherell Coll.

P. 5906. Tooth figured in Dixon's Foss. Suss. pl. xv. fig. 11; Lower Eocene, Bognor, Sussex. *Dixon Coll.*

P. 5511. Imperfect large tooth: Lower Eocene, Portsmouth.
Caleb Evans Coll.

P. 5506. Lateral tooth; Lower Eocene, Portsmouth Docks.
Caleb Evans Coll.

25685 a. Fourteen small teeth; Bracklesham Beds, Bracklesham Bay, Sussex. *Dixon Coll.*

29018. Three small teeth, probably from Bracklesham Bay.
Cowderoy Bequest.

P. 1278. Twelve teeth; Bracklesham Bay. *Egerton Coll.*

P. 5800. Six teeth, probably from Bracklesham Bay.
Enniskillen Coll.

P. 5433. Large tooth, probably from Bracklesham Bay.
Presented by P. E. Coombe, Esq., 1888.

48013. Lateral tooth: Bracklesham Beds, Stubbington, near Gosport, Hampshire. *Purchased*, 1877.

28881. Small tooth: Barton Clay, Barton Cliff, Hampshire.
Daniels Coll.

40244. Twenty-three teeth, some very small; Barton.
Edwards Coll.

P. 55 b. Narrow tooth; Barton.
Presented by Sir Richard Owen, K.C.B., 1880.

P. 1167. Twelve teeth; (?) Barton. *Egerton Coll.*

26485. Large tooth; Red Crag (derived fossil), Woodbridge, Suffolk. *Purchased*, 1851.

P. 1279. Seven teeth: Red Crag (derived fossils), Suffolk.
Egerton Coll.

P. 5579. Four teeth; Red Crag (derived fossils), Felixstowe, Suffolk. *Harford Coll.*

P. 5801. Imperfect abraded tooth, of the form named *Otodus lanceolatus*, Agassiz; Upper Eocene (Ironstone), Kressenberg, Bavaria. *Enniskillen Coll.*

9757. Narrow tooth, resembling No. P. 55 *b*, but smaller in size and with a relatively larger root; Lower Miocene, Cassel.
Mantell Coll.

The following species have also been distinguished upon the evidence of detached teeth, but there are no examples in the Collection:—

Lamna adunca: *Otodus aduncus*, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 26.—Pliocene; Tuscany.

Lamna basalis: *Otodus basalis*, Sir P. Egerton (*non* Giebel, 1847), Quart. Journ. Geol. Soc. vol. i. (1845), p. 168, woodcut; F. Stoliczka, Cret. Fauna S. India (Palæont. Indica), vol. iv. (1873), pt. iv. p. 67, pl. xii. figs. 22, 23.—Upper Cretaceous; Pondicherry, Madras.

Lamna bouchardi, H. E. Sauvage, Catal. Poiss. Form. Second. Boulonnais (Mém. Soc. Acad. Boulogne, vol. ii.), 1867, p. 69, pl. iii. fig. 15.—Gault; Boulogne.

Lamna brandti: *Otodus brandti*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1854, pt. ii. p. 382, pl. ii. fig. 3.—Cenomanian; Government of Orel, Russia.

Lamna cattica: *Otodus catticus*, R. A. Philippi, Palæontogr. vol. i. (1846), p. 24, pl. ii. figs. 5–7.—Lower Miocene: Wilhelmshöhe, Cassel. (? *Lamna macrota*.)

Lamna elevata, L. Agassiz, Amer. Journ. Sci. (2 vol. xxi. (1856), p. 275.—Tertiary; Ocoya Creek, California.

Lamna debilis: *Otodus* (*Pseudolamiakis*) *debilis*, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 155, pl. ii. figs. 78–81.—Molasse; Baltringen, Würtemberg.

Lamna ensiculata, J. W. Davis, Trans. Roy. Dublin Soc. (2 vol. iv. (1888), p. 18, pl. iii. figs. 6, 7.—Oamaru System: New Zealand.

Lamna gracilis, C. G. Giebel, Fauna d. Vorwelt, Fische, 1847, p. 361.—Upper Eocene: Sulldorf, near Magdeburg.

Lamna hastalis: *Otodus hastalis*, R. Lawley, *op. cit.* p. 26.—Pliocene; Tuscany.

(?) *Lamna hectori*, J. W. Davis, *tom. cit.* p. 21, pl. iii. fig. 16.—Lower Cretaceous; Amuri Bluff, New Zealand.

Lamna isoscelicus: *Otodus isoscelicus*, R. Lawley, *op. cit.* p. 26.—Pliocene; Tuscany.

Lamna lawleyi: *Otodus lawleyi*, F. Bassani, Atti Soc. Tosc. Sci. Nat. vol. iii. (1877), p. 80, pl. xi. figs. 3–5; Atti Soc. Veneto-Trent. Sci. Nat. vol. v. (1878), p. 281, and vol. vi. (1879), p. 60; H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. (1882), p. 48, pl. i. figs. 12–14.—Upper Eocene; Vicentin, Italy. Miocene; W. France. (? *Oxyrhina*.)

Lamna lepida, P. Gervais, Zool. et Pal. Franç. (1852), pl. lxxv. fig. 4.—Miocene; Montpellier, Hérault.

Lamna levis: *Otodus levis*, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. 1847, p. 268, and Journ. Acad. Nat. Sci. Philad [2] vol. i. p. 199, pl. xxvi. fig. 141.—Eocene; South Carolina.

Lamna marginata: *Otodus? marginatus*, Sir P. Egerton, *tom. cit.* p. 168, woodcut.—Upper Cretaceous; Pondicherry.

Lamna marroti: *Otodus marroti*, H. Coquand, Descript. Géol. etc. Départ. Charente, vol. ii. (1860), p. 157.—Campanian; Dordogne.

Lamna minor: *Otodus minor*, C. G. Giebel, *op. cit.* Fische, p. 355.—Upper Eocene; Süldorf, near Magdeburg. Also recorded from Westeregeln and Antwerp.

Lamna minuta: *Otodus minutus*, Sir P. Egerton, *tom. cit.* p. 169, woodcut; F. Stoliczka, *tom. cit.* pt. iv. p. 68, pl. xii. figs. 29, 30.—Upper Cretaceous; Pondicherry.

Lamna mitis: *Otodus mitis*, R. A. Philippi, *tom. cit.* p. 24, pl. ii. figs. 2–4.—Lower Miocene; Wilhelmshöhe, Cassel.

Lamna mudgei, E. D. Cope, Vert. Cret. Form. West (Rep. U.S. Geol. Surv. Territ. vol. ii. 1875), p. 297, pl. xlii. figs. 11, 12.—Niobrara Formation; Kansas. Greensand; New Jersey.

Lamna nana: *Otodus nanus*, Sir P. Egerton, *tom. cit.* p. 169, woodcut; F. Stoliczka, *tom. cit.* pt. iv. p. 68, pl. xii. figs. 25–28.—Upper Cretaceous; Pondicherry.

Lamna ornata, L. Agassiz, *tom. cit.* (1856), p. 275.—Tertiary; Ocoya Creek, California.

Lamna plana: *Lamna* (*Sphenodus*) *plana*, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 299, pl. xxxvii. figs. 30–32.—Cenomanian; Switzerland.

(?) *Lamna pseudo-appendiculata*: *Otodus pseudo-appendiculatus*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. (1857), p. 311, pl. vi. *a*. fig. 4.—Formation and locality unknown.

(?) *Lamna recticona*: *Otodus recticonus*, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 275, pl. xxxvi. fig. 34.—Miocene; Malta. (? *Oxyrhina*.)

Lamna renardi: *Otodus renardi*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1854, pt. ii. p. 387, pl. ii. figs. 21–30.—Cenomanian; Governments of Kursk and Orel, Russia.

Lamna reversa, C. G. Giebel, *op. cit.* Fische, p. 360.—Upper Eocene; Süldorf.

(?) *Lamna rudis*: *Otodus rudis*, A. E. Reuss, Verstein. böhm. Kreideform. pt. ii. (1846), p. 99, pl. xxi. figs. 26–40; A. Fritsch, Rept. u. Fische böhm. Kreideform. (1878), p. 6, woodcut fig. 6.—Turonian; Bohemia. (? Hinder teeth of *Lamna semiplicata*.)

Lamna rupeliensis: *Otodus rupeliensis*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. (1871), p. 11, woodcut.—Rupelian; Belgium.

Lamna salentina: *Otodus salentinus*, O. G. Costa, Paleont. Regno Napoli, pt. i. (1850), p. 115, pl. ix. fig. 6.—Miocene; Naples.

Lamna serotina: *Otodus* (*Pseudotriakis*) *serotinus*, J. Probst, Württ. Jahresh. vol. xxxv. (1879), p. 155, pl. ii. figs. 82–85.—Molasse; Baltringen.

Lamna spathula: *Otodus spathula*, H. E. Sauvage, Biblioth. Ecole Hautes Etudes, vol. v. no. 9 (1872), p. 32, pl. i. figs. 27–32.—Senonian; Sarthe, France.

Lamna striata: *Otodus striatus*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. (1876), pp. 8, 24, pl. i. figs. 7–9; G. Vincent, Ann. Soc. Roy. Malacol. Belg. vol. xi. (1876), p. 125, pl. vi. fig. 2.—Heersian and Bruxellian; Belgium.

Lamna subplicata: *Otodus subplicatus*, L. Agassiz (*ex* Münster, MS.), Poiss. Foss. vol iii. (1843), p. 274, pl. xxxvi. fig. 38.—Lower Miocene; Bünde, Prussia.

Lamna sulcata: *Otodus sulcatus*, E. Sismonda (*non* Geinitz, 1843), Mem. R. Accad. Sci. Torino, [2] vol. x. (1849), p. 39, pl. i. figs. 34–36; G. G. Gemmellaro, *tom. cit.* p. 310, pl. i. *a*. fig. 10.—Miocene; Piedmont. [If well founded, requires a new specific name.]

(?) *Lamna tremauxi*: *Galeocerdo tremauxi*, H. E. Sauvage, Bull.

Soc. Géol. France, [3] vol. viii. (1880), p. 457, pl. xiii. fig. 2.—U. Cretaceous (Carentonian); Charente, France.

Lamna undulata, E. Sismonda, *tom. cit.* p. 47, pl. ii. figs. 23, 24. —Middle Tertiary; Piedmont.

Fragmentary teeth of *Lamna* from the Chalk of Sweden are also figured by S. Nilsson, Petrif. Suecana, 1827, pl. x. fig. 1; and a tooth from the Tertiary of Arkansas is figured in D. D. Owen, First Rep. Geol. Reconn. N. Counties of Arkansas, 1858, pl. ix. fig. 7.

A species, *L.* (*Otodus*) *woodwardii*, is founded upon a vertebra from the Cambridge Greensand, by C. Hasse, Palæontogr. vol. xxxi. (1884), p. 8, pl. ii. figs. 13–15; another vertebra from the Cenomanian of Kursk, Russia, is named *Otodus prædator*, E. von Eichwald, Bull. Soc. Imp. Nat. Moscou, 1853, pt. i. p. 221; and other vertebræ, from the Rolling Downs Formation, North Queensland, are described as *Lamna davisii* by R. Etheridge, Jun., Proc. Linn. Soc. N. S. Wales, [2] vol. iii. (1888), p. 159, pl. iv. figs. 2, 3.

In his work, Natürl. Syst. Elasmobr., Besond. Theil (1882), C. Hasse describes vertebræ of *Lamna* from the Plänerkalk of Strehlen, near Dresden (p. 220, pl. xxviii. figs. 8, 9), the Upper Eocene of Kressenberg, Bavaria (p. 220, pl. xxviii. fig. 7), and of Helmstedt, Brunswick (p. 219, pl. xxviii. figs. 10–13), and from the Crag of Antwerp (p. 219).

An example from the Samland Eocene is also described by F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 69, pl. x. fig. 4.

Various vertebræ from the Upper Cretaceous and Tertiaries are also assigned to "*Otodus*" (C. Hasse, *op. cit.* p. 206, pl. xxvii.), which is placed with *Crossorhinus* and *Ginglymostoma* in the Scylliolamnidæ. Some connection between certain forms of *Otodus* and *Squatina* is also suspected by C. Hasse, Morphol. Jahrbuch, vol. ii. (1876), p. 474.

The so-called *Lamna lanceolata*, J. W. Davis (Trans. Roy. Dublin Soc. [2] vol. iv. 1888, p. 20, pl. iii. fig. 12), from New Zealand, is founded upon a tooth evidently not Selachian.

Genus **CARCHARODON**, Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 70.]

Second dorsal fin and the anal very small. A pit at the root of the caudal fin, which has the lower lobe well developed; side of the tail with a keel. Teeth large, erect, triangular, and serrated.

Carcharodon subserratus, Agassiz.

1843. *Carcharodon subserratus*, L. Agassiz, Poiss. Foss. vol. iii. p. 260, pl. xxxvi. figs. 14, 15.

1843. *Carcharodon escheri*, L. Agassiz, *tom. cit.* p. 260, pl. xxxvi. figs. 16–21.

Type. Detached tooth; British Museum.

A small, imperfectly known species. Teeth comparatively broad, compressed, without lateral denticles; serrations upon the coronal edges irregular and faintly marked.

Form. & Loc. London Clay (Lower Eocene): Isle of Sheppey. Upper Eocene: Kressenberg, Bavaria. "Swiss Molasse."

P. 2356. Type specimen; London Clay, Isle of Sheppey.
Enniskillen Coll.

Carcharodon lanciformis, Gibbes.

1847. *Carcharodon lanciformis*, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. p. 267.

1848. *Carcharodon lanciformis*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 147, pl. xxi. figs. 46–51.

Type. Detached teeth.

A species of moderate size. Teeth comparatively broad, much compressed, often with partially separated lateral denticles. The upper lateral teeth often much curved outwards.

Form. & Loc. Eocene (Phosphate Beds): South Carolina.

28103. Five imperfect teeth. *Purchased*, 1852.

P. 5738. Six teeth. *Presented by Miss Caroline Birley*, 1888.

46999 a. Tooth. *Purchased*, 1876.

10535. Tooth, either of this species or the so-called *C. subsidens*.
Mantell Coll.

10537. Ten small teeth, some pertaining to this species, others probably to young of *C. megalodon*. *Mantell Coll.*

Carcharodon auriculatus (Blainville).

1752. Figure by A. Scilla, De Corporibus Marinis, pl. v. fig. 1.

1784. Figures by Burtin, Oryctographie de Bruxelles, pl. I. figs. Q, R.

1818. *Squalus auriculatus*, H. D. de Blainville, Nouv. Dict. d'Hist. Nat. vol. xxvii. p. 384.

1843. *Carcharodon auriculatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 254, pl. xxviii. figs. 17–19.

1843. *Carcharodon angustidens*, L. Agassiz, *tom. cit.* p. 255, pl. xxviii. figs. 20–25, pl. xxx. fig. 3.

1843. *Carcharodon turgidus*, L. Agassiz, *tom. cit.* p. 256, pl. xxx. *a*. figs. 8, 9.

1843. *Carcharodon lanceolatus*, L. Agassiz, *tom. cit.* p. 257, pl. xxx. fig. 1.

1843. *Carcharodon toliapicus*, L. Agassiz, *tom. cit.* p. 257, pl. xxx. *a*. fig. 14.

1843. *Carcharodon heterodon*, L. Agassiz, *tom. cit.* p. 258, pl. xxviii. figs. 11–16.

1843. *Carcharodon megalotis*, L. Agassiz, *tom. cit.* p. 258, pl. xxviii. figs. 8–10.

1843. *Carcharodon disauris*, L. Agassiz, *tom. cit.* p. 259, pl. xxviii. fig. 7.

1844. *Carcharodon auriculatus*, P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. p. 285, pl. i. fig. 23.

1847. *Carcharodon acutidens*, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. p. 267.

1848. *Carcharodon angustidens*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 145, pl. xix. figs. 10–18, pl. xx., pl. xxi. figs. 37, 38.

1848. *Carcharodon acutidens*, R. W. Gibbes, *tom. cit.* p. 146, pl. xxi. figs. 39–44.

(?) 1849. *Carcharodon angustidens*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 36, pl. i. figs. 30, 31.

1849. *Carcharodon heterodon*, E. Sismonda, *tom. cit.* p. 38.

1850. *Carcharodon heterodon*, F. Dixon, Foss. Sussex, p. 204, pl. xi. fig. 19.

1852. *Carcharodon disauris*, P. Gervais, Zool. et Pal. Franç. pl. lxxiv. fig. 6, pl. lxxv. fig. 6.

1854–56. *Carcharodon angustidens*, O. G. Costa, Paleont. Regno Napoli, pt. ii. p. 50, pl. vi. fig. 3.

1854–56. *Carcharodon interamniæ*, O. G. Costa, *op. cit.* pt. ii. p. 53, pl. v. fig. 6.

1857. *Carcharodon angustidens*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 304, pl. v. *a*. fig. 6 *a*.

1857. *Carcharodon angustidens*, var. *turgidus*, G. G. Gemmellaro, *tom. cit.* p. 305, pl. v. *a*. figs. 7, 8 *a*.

1863. *Carcharodon angustidens, turgidus, lanceolatus*, and *heterodon*. K. E. Schafhäutl, Süd-Bay. Leth. Geogn. p. 239, pl. lxiii. figs. 3–5, pl. lxiv. fig. 7.

1863. *Carcharias leptodon*, K. E. Schafhäutl, *op. cit.* p. 241, pl. lxiii. fig 2.

1871. *Carcharodon disauris?*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 12.

1875. *Carcharodon angustidens*, F. M'Coy, Prodrom. Palæont. Victoria (Geol. Survey Victoria), dec. ii. p. 8, pl. xi. figs. 2, 3.

1875. *Carcharodon arndti*, T. C. Winkler, Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. p. 119, pl. iii. fig. 11.

1877. *Carcharodon angustidens*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. p. 253.

1882. *Carcharodon angustidens*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 44.

1883. *Carcharodon angustidens*, H. B. Geinitz, Abh. Naturw. Ges. Isis, Dresden, p. 6, pl. i. fig. 11.

1883. *Carcharodon angustidens*, W. Dames, Sitzungsb. k. preuss. Akad. Wiss. pt. i. p. 145.

1885. *Carcharodon angustidens*, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3. p. 82, pl. vi. figs. 1–3.

1887. *Carcharodon heterodon*, L. Dollo, Revue Quest. Scient. vol. xxii. p. 81.

1888. *Carcharodon angustidens*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 9, pl. i. figs. 4–6, pl. vi. fig. 22.

Type. Detached tooth.

Teeth robust, comparatively narrow, with a pair of broad lateral denticles: outer coronal face flat or slightly convex. Lateral denticles especially large in the lateral teeth, which have a very narrow oblique crown.

The teeth from the English, French, and Bavarian Eocene assigned to this species are generally smaller than those from other localities, but similar in form.

Two nearly complete skeletons, from the Rupelian Beds of Boom, near Antwerp, are preserved in the Royal Museum of Natural History, Brussels (see L. Dollo, *loc. cit.*).

Form. & Loc. Middle and Upper Eocene: S.E. England, N. France, Belgium, Bavaria, S. Carolina, and Alabama. Miocene: W. France, Belgium, N. Germany, Italy, Sicily, and Maryland. Pliocene: Antwerp, Belgium. Lower and Middle Tertiaries: Egypt, Arabia, Victoria [1], and New Zealand.

35598–603, 35612. Two perfect and eight fragmentary teeth; Eocene, Alabama, U.S.A.
Presented by Prof. J. W. Mallet, 1859.

P. 1200. Seven teeth; Eocene, Clarke's Co., Alabama.
Egerton Coll.

P. 2386. Eighteen teeth, some imperfect; Clarke's Co., Alabama.
Enniskillen Coll.

42850. Lateral tooth; Belgium. *Van Breda Coll.*

P. 4095. Very large tooth; Phosphate Beds, Charleston, S. Carolina.
By exchange, 1883.

[1] F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx. (1867), p. 192.

46996–98. Six teeth; South Carolina. *Purchased*, 1876.

25674–5. Two teeth, figured by Dixon, *op. cit.* pl. xi. figs. 11, 19, under the name of *C. heterodon*, Agass.; Bracklesham Beds, Bracklesham Bay, Sussex. *Dixon Coll.*

25676. Ten similar teeth; Bracklesham. *Dixon Coll.*

38865. Robust erect tooth; Bracklesham. *Bowerbank Coll.*

43123. Lateral tooth; Bracklesham. *Wetherell Coll.*

P. 1199. Six teeth; Bracklesham. *Egerton Coll.*

P. 5818. Tooth; Bracklesham. *Cracherode Bequest.*

40310. Lateral tooth; Colesworth, near Woking, Surrey. *Purchased*, 1867.

28372. Five teeth; Calcaire Grossier, Roquet, Paris. *Purchased*, 1853.

29024. Erect tooth, wanting lateral denticles, and another much abraded tooth; Calcaire Grossier, Chaumont, Paris. *Purchased*, 1854.

35536. Six imperfect teeth; Upper Eocene, Kressenberg, Bavaria. *Purchased*, 1859.

P. 367, P. 369. Two dental crowns; Kressenberg. *By exchange.*

P. 4945. Two imperfect teeth; Kressenberg. *Presented by J. E. Lee, Esq.*, 1885.

42007. Small tooth; Eocene, near Brussels. *Purchased*, 1870.

P. 280. Large lateral tooth; Rupelian Beds, Boom, near Antwerp, Belgium. *Transferred from Mus. Practical Geology*, 1880.

P. 1201. Three teeth, and one much abraded; Boom. *Egerton Coll.*

P. 2384, P. 2389. Three teeth; Boom. *Enniskillen Coll.*

41343. Dental crown; Rupelian Beds, Rupelmonde, near Antwerp. *Purchased*, 1869.

28373. Small abraded erect tooth; Miocene, Bordeaux. *Purchased*, 1853.

32734. Large robust dental crown; Miocene, Xabregas, near Lisbon. *Presented by J. S. Valentine, Esq.*, 1875.

P. 2385. Two teeth; Crag, Antwerp. *Enniskillen Coll.*

P. 337 a. Two imperfect small teeth, perhaps of this species, from the Arabian Desert.

Presented by Sir Richard Owen, K.C.B., 1881.

Carcharodon megalodon, Agassiz.

1752. Figures by A. Scilla, De Corporibus Marinis, pl. iii. fig. 1, pl. v. fig. 2, pl. vi. fig. 1.

1818. *Carcharias verus*, H. D. de Blainville, Nouv. Dict. d'Hist. Nat. vol. xxvii. p. 384[1].

1837. *Carcharias megalodon*, E. Charlesworth, Mag. Nat. Hist. n. s. vol. i. p. 225, woodc. fig. 24.

1843. *Carcharodon megalodon*, L. Agassiz, Poiss. Foss. vol. iii. p. 247, pl. xxix.

1843. *Carcharodon rectidens*, L. Agassiz, *tom. cit.* p. 250, pl. xxx. *a*. fig. 10.

1843. *Carcharodon subauriculatus*, L. Agassiz, *tom. cit.* p. 251, pl. xxx. *a*. figs. 11–13.

1843. *Carcharodon productus*, L. Agassiz, *tom. cit.* p. 251, pl. xxx. figs. 2, 4, 6, 7, 8.

1843. *Carcharodon polygyrus*, L. Agassiz, *tom. cit.* p. 253, pl. xxx. figs. 9–12.

1844. *Carcharodon megalodon*, P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. p. 286, pl. i. fig. 26.

1848. *Carcharodon megalodon*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 143, pl. xviii., pl. xix. figs. 8, 9.

1849. *Carcharodon megalodon*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 34, pl. i. figs. 8–13.

1849. *Carcharodon crassidens*, E. Sismonda, *tom. cit.* p. 35, pl. i. figs. 32, 33.

1849. ***Carcharodon polygyrus*, E. Sismonda, *tom. cit.* p. 36.**

1849. *Carcharodon productus*, E. Sismonda, *tom. cit.* p. 37, pl. i. figs. 25–29.

1850. *Carcharodon megalodon*, O. G. Costa, Paleont. Regno Napoli, pt. i. p. 117, pl. ix. fig. 2.

1852. *Carcharodon megalodon*, P. Gervais, Zool. et Pal. Franç. pl. lxxiv. figs. 11, 12, pl. lxxv. fig. 10.

1854. *Carcharodon megalodon*, R. Owen, Cat. Foss. Rept. & Pisces Mus. R. Coll. Surgeons, p. 124.

1854–56. *Carcharodon megalodon*, O. G. Costa, Paleont. Regno Napoli, pt. ii. p. 46, pl. v. figs. 2, 3, pl. vi. fig. 1.

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[1] This specific name refers to the existing *Carcharias lamia*, to which Blainville assigned the fossil teeth.

1854-56. *Carcharodon auriculatus*, O. G. Costa, *op. cit.* pt. ii. p. 48, pl. v. fig. 5.

1854-56. *Carcharodon rectidens*, O. G. Costa, *op. cit.* pt. ii. p. 51, pl. v. fig. 4, pl. vi. fig. 2.

1854-56. *Carcharodon productus*, O. G. Costa, *op. cit.* pt. ii. p. 52, pl. v. fig. 1.

1854-56. *Carcharodon arcuatus*, O. G. Costa, *op. cit.* pt. ii. p. 56, pl. vi. fig. 4.

1854-56. *Carcharodon latissimus*, O. G. Costa, *op. cit.* pt. ii. p. 55, pl. v. fig. 8.

1857. *Carcharodon megalodon*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 290, pl. ii. *a*.

1857. *Carcharodon megalodon*, var. *siculus*, G. G. Gemmellaro, *tom. cit.* p. 300, pl. iii. *a*. figs. 1–3.

1857. *Carcharodon megalodon*, var. *subauriculatus*, G. G. Gemmellaro, *tom. cit.* p. 301, pl. iv. *a*. figs. 1 *a*–3 *a*.

1857. *Carcharodon productus*, G. G. Gemmellaro, *tom. cit.* p. 306, pl. v. *a*. figs. 3 *a*–5 *a*.

1857. *Carcharodon latissimus*, G. G. Gemmellaro, *tom. cit.* p. 307, pl. iv. *a*. fig. 4.

(?) 1861. *Carcharodon heterodon*, G. Michellotti, Miocène Inf. Italie Septentr. (Mém. Soc. Holland. Sci.), p. 143, pl. xiv. figs. 8, 9.

1865. *Carcharodon crassus*, O. G. Costa, Paleont. Regno Napoli, Append. i. p. 102, pl. vi. fig. 1.

1865. *Carcharodon auriculatus*, var. *falciformis*, O. G. Costa, *op. cit.* Append. i. p. 104, pl. vi. fig. 2.

1870. *Carcharodon megalodon*, F. Roemer, Geol. von Oberschlesien, pl. xlviii. fig. 16.

1871. *Carcharodon megalodon*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 7.

(?) 1872. *Carcharodon helveticus* and *Carcharodon turicensis*, K. Mayer, Syst. Verzeichn. Verstein. Helvetian Schweiz u. Schwabens, p. 35 (names only)[1].

1875. *Carcharodon megalodon*, F. M'Coy, Prodr. Palæont. Victoria, (Geol. Surv. Vict.), dec. ii. pl. xi. fig. 4.

1876. *Carcharodon megalodon*, *rectidens*, *productus*, and *polygyrus*, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane, pp. 22, 23.

1877. *Carcharodon megalodon*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. p. 253.

1877. *Carcharodon megalodon*, K. Miller, Das Molassemeer Bodenseegeg. p. 65, pl. iii. fig. 72.

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[1] Through the kindness of Prof. Mayer-Eymar, the writer has had the opportunity of studying the original teeth thus named. They are insufficient for definite determination; but the types of *C. helveticus* closely resemble the lower teeth of *C. megalodon*, and that of *C. turicensis* the hinder teeth of the same species.

1877. *Carcharodon megalodon*, A. Locard, Faune Terr. Tert. Moy. Corse, p. 8.

1879. *Carcharodon megalodon*, F. Bassani, Atti Soc. Veneto.-Trent. Sci. Nat. vol. vi. p. 62.

1879. *Carcharodon megalodon*, J. Probst. Württ. Jahresh. vol. xxxv. p. 138.

1879. *Carcharodon megalodon*, K. Martin, Zeitschr. deutsch. geol. Ges. vol. xxxi. p. 478.

1881. *Carcharodon megalodon*, R. Lawley, Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, p. 35, pls. vi.–xi. (*Carcharodon*), pl. iv. (*Carcharodon*), fig. 1.

1882. *Carcharodon megalodon*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 41, pl. i. fig. 11.

1882. *Carcharodon polygyrus*, H. E. Sauvage, *tom. cit.* p. 43, pl. i. fig. 10.

1883. *Carcharodon megalodon*, K. Martin, Samml. geol. Reichs-Mus. Leiden, [1] vol. iii. p. 23, pl. i. fig. 12.

1888. *Carcharodon megalodon*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 12, pl. ii. figs. 1–3.

1888. *Carcharodon robustus*, J. W. Davis, *tom. cit.* p. 13, pl. i. fig. 7.

Type. Detached teeth; Museums of Carlsruhe, Strassburg, and Paris.

A species attaining to a very large size, the teeth being sometimes as much as 0·15 in total height. Teeth comparatively broad and robust, the outer coronal face flat or slightly convex, the apex sometimes gently curved outwards; distinct lateral denticles absent.

Form. & Loc. Eocene and Phosphate Beds: Alabama and South Carolina, U.S.A. Miocene: France, Spain, Portugal, Malta, Sicily, Corsica, Germany, Austria, and Maryland. Pliocene: Italy, Belgium, and S.E. England. Various Tertiary Deposits: Arabian Desert, East Indies, West Indies, Central and South America, Victoria[1], South Australia, and New Zealand.

28103. Fragmentary tooth; Phosphate Beds, Cooper River, South Carolina, U.S.A. *Purchased*, 1852.

16994-5. Three very large teeth, one measuring 0·127 in maximum breadth and 0·15 in height: Wimbee and Parrott Creeks, St. Helena Sound, S. Carolina. *Purchased*, 1876.

P. 5816. Two teeth, slightly smaller: S. Carolina. *Purchased*.

P. 4094. Large tooth: Ashley River Phosphate Beds, Charleston S. Carolina. *By exchange*, 1883.

[1] F. M'Coy, Ann. Mag. Nat. Hist. [3] vol. xx. (1867), p. 192.

P. 4939. Similar tooth; Charleston.
Presented by J. E. Lee, Esq., 1885.

P. 1191, P. 1198. Imperfect large tooth, and small abraded tooth; Miocene, Maryland. *Egerton Coll.*

P. 5806. Fragmentary tooth, labelled by Agassiz "*Carcharias macrodon*"; Maryland. *Enniskillen Coll.*

P. 2383 a. Small abraded tooth, referred to *C. polygyrus* by Agassiz, *tom. cit.* p. 253; Eocene (or Miocene), Newburn, N. Carolina. *Enniskillen Coll.*

P. 2388. Three small teeth, probably hinder teeth of this species; Eocene, Clarke's County, Alabama. *Enniskillen Coll.*

35538 Tooth; "Miocene, United States."
Presented by the Hon. E. Chitty, 1859.

40354. Dental crown; Miocene, Anjou, France. *Purchased*, 1867.

28376. Tooth; Miocene, Bordeaux. *Purchased*, 1853.

P. 1192. Dental crown; Miocene, Ardèche, S. France.
Egerton Coll.

P. 1193. Small tooth; M. Miocene, Sansan, Gers, France.
Egerton Coll.

32734. Apex of tooth; Miocene, Sacavem, near Lisbon.
Presented by J. S. Valentine, Esq., 1857.

32734 a. Three small teeth, probably of this species; Miocene, Xabregas, near Lisbon.
Presented by J. S. Valentine, Esq., 1857.

38643. Tooth; Miocene, Tejares, Malaga. *Purchased*, 1860.

172, 995, 998, 1066, 1073, 1082, 1279 (Sloane Cat.). Seven teeth; Miocene, Malta. *Sloane Coll.*

1956. Dental crown; Malta. *Presented by Miss Attersoll.*

20569. Four erect teeth; Malta. *Purchased*, 1845.

24595, 24600, 24855. Six teeth, and three others much broken; Malta. *Purchased*, 1850.

28375. Large perfect tooth; Malta. *Purchased*, 1853.

28539. Large tooth, and lateral tooth; Malta. *Dixon Coll.*

29026. Small erect tooth; Malta. *Purchased*, 1854.

36072. Large tooth; Malta. *Purchased*, 1861.

39042. Large tooth; Malta. *Bowerbank Coll.*

41769. Imperfect lateral tooth; Malta. *Purchased*, 1869.

50011–12. Large tooth, and imperfect lateral tooth; Malta. *Trevelyan Bequest.*

P. 5817. Perfect tooth, and fragment; Malta. *Cracherode Bequest.*

P. 1190. Nine teeth; Malta. *Egerton Coll.*

P. 1195–6. Nine small lateral teeth; Malta. *Egerton Coll.*

P. 2383, P. 2390, P. 2392–3, P. 4566–68. Sixteen teeth, some large, some imperfect; Malta. *Enniskillen Coll.*

P. 4666. Three teeth: Malta. *Purchased*, 1884.

P. 4884. Dental crown; Malta. *Presented by Joshua Brown, Esq.*, 1885.

42064. Large dental crown; (?) Malta. *Presented by Mrs. Balfour*, 1870.

P. 5807. Imperfect dental crown; Molasse, Hohenzollern, Germany. *Purchased.*

P. 5124. Tooth; "Miocene, Vienna Basin." *Purchased*, 1886.

P. 1194. Four teeth; formation and locality unknown, but probably Antwerp Crag. *Egerton Coll.*

P. 5808. Tooth; Crag, Antwerp. *Enniskillen Coll.*

49459. Abraded tooth; Red Crag, Woodbridge, Suffolk. *Purchased*, 1878.

39004–5. Two abraded teeth; Red Crag, near Felixstowe, Suffolk. *Bowerbank Coll.*

P. 1197. Four abraded teeth; Felixstowe. *Egerton Coll.*

P. 337. Two teeth, and six fragmentary teeth; Arabian Desert. *Presented by Sir Richard Owen, K.C.B.*, 1881.

46505. Tooth; Paradise Bay, Jamaica.
Presented by Thomas Kerr, Esq., 1875

P. 5911. Large tooth; Seven Brothers, St. Domingo.
Presented by Sir Robert Schomburgk, 1836.

P. 278. Small tooth; Cuba.
Transferred from Mus. Practical Geology, 1880.

36328. Small tooth, noticed by C. C. Blake, 'The Geologist,' vol. v. p. 316; Aspinwall, Darien. *Purchased*, 1862.

P. 5810. Imperfect small tooth; from Guimbi, Province of Esmeralda, Ecuador. *History unknown.*

P. 279. Dental crown; South America.
Transferred from Mus. Practical Geology, 1880.

P. 5216. Plaster cast of large tooth; Upper Tertiary, Lake Bonny, S. Australia.
Presented by Sir Samuel Davenport, K.C.M.G., 1886.

P. 5809. Imperfect large dental crown; Wanganui Beds(?), between N. Plymouth and Adelaide, New Zealand.
Presented by Dr. J. S. Bowerbank.

P. 2309. Small tooth; Trelissic Formation, New Zealand.
By exchange, 1876.

Carcharodon rondeletii, Müller & Henle.

1841. *Carcharodon rondeletii*, Müller & Henle, Syst. Beschreib. Plagiostom. p. 70[1].

1843. *Carcharodon sulcidens*, L. Agassiz, Poiss. Foss. vol. iii. p. 254, pl. xxx. *a*. figs. 3–7.

(?) 1848. *Carcharodon sulcidens*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 147, pl. xxi. figs. 52, 53.

1857. *Carcharodon sulcidens*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 308, pl. iv. *a*. figs. 5–7.

1857. *Carcharodon tornabene*, G. G. Gemmellaro, *tom. cit.* p. 309, pl. i. *a*. fig. 12.

1881. *Carcharodon etruscus*, R. Lawley, Studi Comp. Pesci foss. coi viventi gen. *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, p. 17, pls. ii., iii., v. (*Carcharodon*), pl. iv. (*Carcharodon*), fig. 2.

Type of C. sulcidens. Detached teeth; Palæontological Museum, Munich (Münster Collection).

[1] For other references to the recent fish, see A. Günther, Cat. Fishes Brit. Mus. vol. viii. p. 392.

The type species of moderate size. Teeth comparatively broad, compressed, without indications of lateral denticles. Coronal apex often slightly curved outwards; external coronal face of the upper teeth often marked by few vertical wrinkles.

As the result of Lawley's researches, the fossil teeth here enumerated may be regarded as pertaining to the existing species.

Form. & Loc. Pliocene: Italy, Sicily, and England. (?) Miocene and Eocene: South Carolina, U.S.A. Newer Tertiary: Chili.

27029–30, 27520. Nine abraded teeth; Red Crag, Sutton, Suffolk. *Purchased*, 1851–52.

41341. Eight abraded teeth; Red Crag, Suffolk. *Brown Coll.—Presented by Sir Richard Owen, K.C.B.*, 1859.

P. 5805. Tooth with scarcely abraded crown; Coralline Crag, Orford, Suffolk. *Purchased.*

P. 2313. Imperfect tooth, much resembling those of this species; Older Miocene (?), New Zealand. *By exchange*, 1876.

47022. Tooth and dental crown: Orciano, Tuscany. *Purchased*, 1875.

P. 5550. Four teeth, more or less imperfect; Piacenza, N. Italy. *By exchange*, 1888.

48996. Seven teeth; Newer Tertiary, Coquimbo, Chili. *Presented by C. J. Lambert, Esq.*, 1878.

The following species are also recognized upon the evidence of detached teeth, though it is not improbable that some of the names are synonyms of those recorded above:—

Carcharodon brevis, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. (1871), p. 7, woodcut.—Pliocene; Belgium.

Carcharodon caifassii, R. Lawley, Nuovi Studi Pesci etc. Colline Toscane (1876), p. 23.—Pliocene; Tuscany.

Carcharodon costa, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. (1857), p. 303, pl. v. *a*. figs. 1 *a*, 2 *a*.—Miocene; Sicily. [? *C. megalodon.*]

Carcharodon gibbesii, G. Michelotti, Miocène Inf. Italie Septentrionale (Mém. Soc. Holland. Sci. Haarlem, 1861), p. 143, pl. xiv. figs. 5–7.—Miocene; N. Italy.

Carcharodon leptodon, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 259, pl. xxviii. figs. 1–6.—Formation and locality unknown.

Carcharodon longidens, L. Pillet, Mém. Acad. Sci. Savoie, [3] vol. ix. (1883), p. 277, with plate.—(?) Danian; Haute Savoie.

Carcharodon microdon, H. Le Hon, *op. cit.* p. 7, woodcut.—Pliocene; Belgium.

Carcharodon mortoni, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. 1847, p. 266; Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1848), p. 146, pl. xxi. fig. 45.—Phosphate Beds; South Carolina.

Carcharodon rectus, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 274.—Tertiary; Ocoya Creek, California.

Carcharodon semiserratus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 256, pl. xxx. *a*. figs. 1, 2.—Miocene; Malta.

Carcharodon simus, F. Bassani, Atti Soc. Tosc. Sci. Nat. vol. iii. (1877), p. 77, pl. xi. fig. 1; Atti Soc. Veneto-Trent. Sci. Nat. vol. v. (1878), p. 280.—Miocene; Creazzo, Italy.

Carcharodon tumidissimus, O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 54, pl. v. fig. 7.—Miocene; Naples.

A detached dental crown of *Carcharodon*, from the Chalk or Tertiary beds of Manganischlak, Caspian Sea, is also described by E. von Eichwald, Geogn.-paleont. Bemerk. Halbinsel Manganischlak (1871), p. 66, pl. iv. figs. 8, 9 (*C. subidens*). Another tooth, from the Siwalik Formation of Pegu, Burmah, is described by R. Lydekker, Pal. Ind. [10] vol. iii. (1886), p. 243, pl. xxxv. fig. 8.

A large vertebra from the Crag of Antwerp, very suggestive of the vertebra of *Cetorhinus* (*Selache*), is described under the name of *Carcharodon selachoides* by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 229, pl. xxx. fig. 35; and another is figured on pl. xxx. fig. 34.

Vertebræ from the Samland Eocene are also assigned to *Carcharodon* by F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 88, pl. x. figs. 1, 2.

Genus **CORAX**, Agassiz.

[Poiss. Foss. vol. iii. 1843, p. 224.]

An imperfectly definable genus, comprising species of small or moderate size, known only by the teeth. Teeth compressed, more or less triangular, usually with distinct marginal serrations; in external form very suggestive of the teeth of *Sphyrna* (*Zygæna*) or *Carcharias*, but differing in the absence of an internal cavity.

Corax pristodontus, Agassiz.

1799. *Dents de Squales*, Faujas St. Fond, Hist. Nat. Mt. St.-Pierre de Maestricht, p. 110, pl. xviii. figs. 1, 9.

1834. *Galeus pristodontus*, S. G. Morton, Synopsis Org. Remains Cret. U. States, pl. xi. fig. 6, and Amer. Journ. Sci. vol. xxviii. p. 277.

1843. *Corax pristodontus*, L. Agassiz, Poiss. Foss. vol. iii. p. 224, pl. xxvi. figs. 9–13.

1843. *Corax kaupii*, L. Agassiz, *tom. cit.* p. 225, pl. xxvi. figs. 4–8, pl. xxvi. *a*. figs. 25–34.

(?) 1843. *Corax appendiculatus*, L. Agassiz, *tom. cit.* p. 227, pl. xxvi. *a*. figs. 16–20[1].

1845. *Corax pristodontus*, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. i. p. 167 (woodc.).

1849. *Galeocerdo pristodontus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 192, pl. xxv. fig. 70.

1852. *Corax appendiculatus?*, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. fig. 18.

1854. *Corax pristodontus*, E. Hébert, Mém. Soc. Géol. France, [2] vol. v. p. 353, pl. xxvii. fig. 8.

1887. *Corax pristodontus*, K. A. von Zittel, Handb. Paläont. vol. iii. p. 84, fig. 88.

1888. *Corax pristodontus*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 293.

Type. Detached teeth.

The type species attaining to a comparatively large size, some of the teeth measuring 0·028 across. Teeth low and broad, with a very large root; anterior coronal margin much arched; serrations distinct.

Form. & Loc. Danian: Holland and Belgium. Upper Senonian: S.E. England and N. France (? also Aix-la-Chapelle). Upper Cretaceous: S. India, N. Africa, and New Jersey. Eocene: Alabama.

28276. Tooth with broken apex; Maastricht Beds, Holland.
Purchased, 1853.

42980. Seven teeth and one dental crown; Maastricht.
Van Breda Coll.

P. 2332. Four teeth; Maastricht. *Enniskillen Coll.*

[1] These may be the hinder teeth either of *C. pristodontus* or *C. affinis*. With them, H. E. Sauvage (Bull. Soc. Géol. France, [3] vol. viii. 1880, p. 456, pl. xiii. fig. 4) also associates *Corax parallelus*, H. Coquand, and *C. trapezoidalis*, H. Coquand (Descript. Géol. etc. Départ. Charente, vol. ii. 1860, p. 97).

P. 5907. Anterior tooth : Craie de Ciply, Belgium.

42875. Dental crown ; Ciply. *Van Breda Coll*

P. 5827. Fourteen naturally associated teeth ; Craie phosphatée, Ciply. *Presented by Mons. A. Houzeau de Lehaie*, 1888.

P. 5828. Four teeth ; Poudingue de Malogne, Ciply.
Presented by Mons. A. Houzeau de Lehaie, 1888.

35649, 35651. Crown of anterior tooth, and three other dental crowns ; Upper Chalk, Norwich. *Bayfield Coll.*

48946. Ten teeth ; Norwich. *Bayfield Coll.*

P. 592. Tooth described and figured by Egerton, *loc. cit.* ; Upper Cretaceous, Pondicherry, Madras. *Egerton Coll.*

35609. Nine imperfect teeth ; Eocene, Alabama.
Presented by Prof. J. W. Mallet, 1859.

P. 2350. Three teeth ; Alabama. *Enniskillen Coll.*

P. 5811. Tooth ; Cretaceous, Aix-la-Chapelle.

P. 1203, P. 2353. Five small teeth, of the form named *C. kaupii*. Agassiz ; "Greensand," Aix-la-Chapelle.
Egerton & Enniskillen Colls.

Corax falcatus, Agassiz.

1822. *Squalus galeus?*, G. A. Mantell, Foss. S. Downs, p. 227, pl. xxxii. figs. 12-16.
1839. *Galeus pristodontus*, H. B. Geinitz (*ex* Agassiz, MS.), Charact. Schicht. u. Petrefakt. sächs.-böhm. Kreidegeb. p. 11, pl. i. fig. 1.
1839. *Galeus appendiculatus*, H. B. Geinitz (*ex* Agassiz, MS.), *op. cit.* p. 11, pl. i. fig. 2.
1843. *Corax falcatus*, L. Agassiz, Poiss. Foss. vol. iii. p. 226, pl. xxvi. fig. 14, pl. xxvi. *a*. figs. 1–15.
1845. *Corax heterodon*, A. E. Reuss, Verstein. böhm. Kreideform. pt. i. p. 3, pl. iii. figs. 49–71.
1845. *Corax obliquus*, A. E. Reuss, *op. cit.* pt. i. p. 4, pl. iv. figs. 1–3.
1850. *Corax falcatus*, F. Dixon, Foss. Sussex, pl. xxx. fig. 18.
(?) 1850. *Corax maximus*, F. Dixon, *op. cit.* p. 306, pl. xxx. fig. 17.
1852. *Corax heterodon*, F. Roemer, Kreidebild. von Texas, p. 30, pl. i. fig. 8.
1853. *Corax heterodon*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, pt. ii. p. 293, pl. ii.
1858. *Corax falcatus*, Pictet & Campiche, Foss. Terr. Crétacé St. Croix, p. 80, pl. x. figs. 1, 2.

1860. *Corax elongatus*, H. Coquand, Descript. Géol. etc. Départ. Charente, vol. ii. p. 97.

1860. ***Corax boreani***, H. Coquand, *op. cit.* vol. ii. p. 134.

1872. *Corax falcatus*, H. E. Sauvage, Bibliothèque Ecole Hautes Etudes, vol. v. art. 9, p. 40, pl. ii. figs. 84, 85.

1872. *Corax kampii* and *Corax* sp., H. E. Sauvage, *ibid.* pp. 41, 42, pl. ii. figs. 80–83.

1873. *Galeocerdo falcatus*, J. Leidy, Ext. Vert. Fauna W. Territ. (Rep. U.S. Geol. Surv. vol. i. pt. i.) p. 301, pl. xviii. figs. 29–42.

1874. *Corax heterodon*, St. Zareczuego, Sprawozd. Komisyi Fizyjograf. Galicyi, vol. viii. p. (127), pl. i. fig. 2.

1875. *Corax heterodon*, H. B. Geinitz, Palæontogr. vol. xx. pt. ii. p. 210, pl. xl. figs. 2–15.

1878. *Corax heterodon*, A. Fritsch, Rept. u. Fische böhm. Kreideform. p. 11, woodc., figs. 23, 24.

1878. *Corax heterodon*, St. Zareczuego, *loc. cit.* vol. xii. p. (202).

1880. *Corax falcatus*, H. E. Sauvage, Bull. Soc. Géol. France, 3. vol. viii. p. 456.

1888. *Corax falcatus*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 293 (in part).

1888. *Sphyrna* cf. *plana*, S. Nikitin, Mém. Com. Géol. vol. v. no. 2, p. 40, pl. v. fig. 8.

Type. Detached teeth: British Museum and Munich Museum.

A species rarely attaining to so large a size as *C. pristodontus*: teeth scarcely differing from those of the latter species, except in the more prevalent elevation of the dental crown and the less arched character of the anterior coronal margin. Coronal serrations generally distinct, but sometimes absent in the small teeth.

A large series of teeth of this species is figured by Reuss under the name of *C. heterodon*.

Form. & Loc. Cenomanian and Turonian: S. England, N. France, Switzerland, Saxony, Bohemia, Galicia, and Russia. Senonian: S.E. England, and N.E. France. Cretaceous: Kansas, Texas, New Jersey, and Mississippi, U.S.A.

4454, 4457, 4465. Three of the type specimens, figured by Agassiz, *tom. cit.* pl. xxvi. *a*. figs. 1, 3, 6; Chalk, Sussex. *Mantell Coll.*

4455, 4456, 4458, 4462, 4464, 4465 a, 4468, 4469, 4471. Twenty-three teeth, the second figured by Mantell, *op. cit.* pl. xxxii. fig. 12; Sussex. *Mantell Coll.*

25824. Tooth figured by Dixon, *op. cit.*; Sussex. *Dixon Coll.*

25796, 25799, 25809, 25815, 25946. Six teeth: Sussex. *Dixon Coll.*

P. 5400. Tooth ; near Lewes, Sussex.
Presented by P. E. Coombe, Esq., 1888.

49942. Two teeth, one erect ; Eastbourne, Sussex. *Capron Coll.*

49943. Two teeth ; Houghton Pit, Arundel, Sussex. *Capron Coll.*

49945. Two imperfect large teeth ; Upper Chalk, Guildford.
Capron Coll.

49944, 49946. Four small teeth ; Upper Chalk, Shalford, near Guildford. *Capron Coll.*

49953. Small abnormal tooth ; Upper Chalk, St. Catherine's Hill, Guildford. *Capron Coll.*

49941. Three teeth ; Chalk, Dorking, Surrey. *Capron Coll.*

36317. Three large dental crowns ; Chalk, Grays, Essex.
Daniels Coll.

20289. Six teeth, one erect ; Chalk, Greenhithe, Kent.
Purchased, 1846.

23156. Tooth ; Chalk, Kent. *Purchased*, 1849.

25766. Large tooth ; Chalk, Bromley, Kent. *Dixon Coll.*

33211. Four teeth ; Chalk, Kent. *Purchased*, 1858.

37754. Broad tooth ; Chalk, Kent. *Purchased*, 1863.

40544. Three teeth ; Chalk, (?) Kent. *Purchased*, 1867.

41705, 41707. Seven teeth ; Chalk, Kent. *Toulmin Smith Coll.*

P. 1204. Six teeth ; Chalk, Kent. *Egerton Coll.*

P. 2333. Two small and three large teeth, the latter labelled *C. pristodontus* by Agassiz ; Chalk, Kent. *Enniskillen Coll.*

P. 4099. Five small teeth ; Chalk, near Margate, Kent.
Presented by Sydney C. Cockerell, Esq., 1883.

P. 403 a. Two teeth ; Chalk, probably Kent.
Presented by the Earl of Ducie, 1881.

47919. Three teeth ; Chalk, near Maidstone.
Presented by the Hon. Robert Marsham, 1877.

28295. Nine imperfect teeth ; Upper Chalk, Mont Aimé, Marne, France. *Purchased*, 1851.

47145, P. 48. Eight teeth; Grey Chalk, Dover. *Gardner Coll.*

29860. Tooth; Craie glauconeuse, Rouen, France.
Purchased, 1855.

P. 5370. Imperfect tooth: Cambridge Greensand, Cambridge.
Presented by James Carter, Esq., 1887.

28892. Six dental crowns; Plänerkalk, Strehlen, near Dresden, Saxony. *Dixon Coll.*

P. 284, P. 299. Six teeth; Strehlen.
Transferred from Mus. Practical Geology, 1880.

P. 1205. Nine teeth; Strehlen. *Egerton Coll.*

P. 2334. Ten teeth; Strehlen. *Enniskillen Coll.*

37234. Tooth: Plänerkalk, Oustí, near Labem, Bohemia.
Purchased, 1863.

P. 5561. Four teeth; Cenomanian, Saratov, Russia.
By exchange, 1888.

24412. Three teeth; Warminster. *Purchased*, 1849.

24498, 30542. Two detached dental crowns, probably of this species: Upper Greensand ("junction bed"), Warminster, Wiltshire. *Purchased*, 1849.

P. 1207. Dental crown, probably of this species; "Greensand, Kelheim," Bavaria. *Egerton Coll.*

The following teeth are of comparatively large size, and provisionally assigned to *C. falcatus*:—

25758. Type specimen of *Corax maximus*, Dixon, *loc. cit.*; Upper Chalk, Houghton, Sussex. *Dixon Coll.*

P. 1206. Similar tooth: Chalk, Sussex. *Egerton Coll.*

Corax affinis, Agassiz.

1843. *Corax affinis*, L. Agassiz, Poiss. Foss. vol. iii. p. 227, pl. xxvi. fig. 2, pl. xxvi. *a.* figs. 21–24.
1843. *Corax appendiculatus*, L. Agassiz, *tom. cit.* pl. xxvi. fig. 3.
1843. *Corax planus*, L. Agassiz, *tom. cit.* p. 229, pl. xxvi. *a.* figs. 51–57.
1847. *Carcharodon minor*, C. G. Giebel, Fauna d. Vorw., Fische, p. 349.
1852. Espèce voisine des *Corax* et des *Sphyrna*, P. Gervais, Zool. et Pal. Franç. pl. lxxvi. fig. 19.

1854. *Sphyrna plana*, E. Hébert, Mém. Soc. Géol. France, [2] vol. v. p. 354, pl. xxvii. fig. 9.

1888. *Corax falcatus*, A. S. Woodward, Proc. Geol. Assoc. vol. x. p. 293 (in part).

Type. Detached teeth.

A small species; principal teeth with a much elevated slender crown, notched prominently at the base of the hinder margin, and less so upon the anterior margin, thus producing a broad posterior denticle and a less distinct anterior denticle. Coronal serrations feeble, often absent.

The present writer has examined microscopical sections of these teeth, and confirmed Agassiz's determination of the absence of an internal cavity.

Form. & Loc. Danian: Holland and Belgium.. Upper Senonian: S.E. England and N. France.

42987. Two teeth, one being almost symmetrical and erect; Maastricht Beds, Holland. *Van Breda Coll.*

44842 a. Almost symmetrical erect tooth; Maastricht. *Presented by Benjamin Bright, Esq.*, 1873.

42986. Two posterior teeth; Maastricht. *Van Breda Coll.*

P. 2355. Posterior tooth; Maastricht. *Enniskillen Coll.*

28719. Two teeth: Craie phosphatée, Ciply, near Mons, Belgium. *Purchased*, 1853.

P. 5557. Tooth; Ciply. *By exchange*, 1888.

P. 5826. Eight teeth; Poudingue de Malogne, Ciply. *Presented by Mons. A. Houzeau de Lehaie*, 1888.

35904. Imperfect tooth; Limbourg. *Purchased*, 1860.

35650. Two teeth; Upper Chalk, Norwich. *Bayfield Coll.*

36916. Tooth; Norwich. *Presented by — Hill, Esq.*, 1862.

48947, 48956 e. Seventeen teeth, more or less perfect: Norwich. *Bayfield Coll.*

P. 5812. Four teeth; Norwich. *History unknown.*

P. 1208, P. 2354. Two abraded dental crowns, the second figured by Agassiz, *tom. cit.* pl. xxvi. *a.* fig. 56 (*Corax planus*); Aix-la-Chapelle. *Egerton & Enniskillen Colls.*

P. 2350 a. Tooth either of this or a closely allied species, larger than the typical teeth; Eocene, Alabama, U.S.A. *Enniskillen Coll.*

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Corax antipus, E. E. Deslongchamps, Le Jura Normand, Mon. vi. (1877), p. 4, pl. i. figs. 4–5.—Lower Oolite; Normandy.

Corax incisus, Sir P. Egerton, Quart. Journ. Geol. Soc. vol. i. (1845), p. 168, woodcut.—Upper Cretaceous: Pondicherry, Madras, India.

Corax laevis, C. G. Giebel, Fauna d. Vorwelt, Fische, p. 371.—Turonian; Quedlinburg, Prussia.

Corax pygmæus, G. von Münster, Beitr. Petrefakt. vii. (1846), p. 19. *Galeus pygmæus*, G. von Münster, *op. cit.* v. (1842), p. 66.—Miocene; Vienna Basin. [The generic position of this tooth is said to have been decided by microscopical examination.]

The so-called *Corax fissuratus*, T. C. Winkler (Archiv. Mus. Teyler, vol. iii. (1874), p. 299, pl. vii. fig. 4), from the Bruxellian Beds of Belgium, is founded upon a tooth of a Ganoid or Teleostean (see W. Dames, Ueber *Ancistrodon*, Debey, in Zeitschr. deutsch. geol. Ges. vol. xxxv. 1883, p. 655).

A few teeth of doubtful Lamnidæ, in form somewhat suggestive of *Corax*, are named *Xiphodolamia*, J. Leidy, Journ. Acad. Nat. Sci. Philad. [2] vol. viii. (1877), p. 251. Two species are distinguished from the Ashley River Phosphate Beds, South Carolina:—*X. gracilis*, Leidy (*loc. cit.* p. 251, pl. xxxiv. figs. 33, 34) and *X. simplex*, Leidy (*loc. cit.* p. 251, pl. xxxiv. figs. 35, 36). The following specimens are also closely similar:—

49954. Small tooth; Lower Chalk, Guildford. *Capron Coll.*

P. 5813. Larger stouter tooth; Cenomanian, Saratov, Russia. *By exchange*, 1888.

Genus **CETORHINUS**, H. D. de Blainville.

[Bull. Soc. Philom. 1816, p. 121.]

Syn. *Selache*, G. Cuvier, Règne Animal, vol. ii. 1817, p. 129.
Hammocera, P. J. van Beneden, Bull. Acad. Roy. Sci. Belge, [2] vol. xxxi. 1871, p. 504.

Second dorsal fin and the anal very small. A pit at the root of the caudal fin; side of the tail with a keel. Gill-clefts very large and wide. Teeth very small, numerous, and conical, without lateral denticles, and rarely or never serrated.

Cetorhinus duponti, Hasse.

1882. *Selache duponti*, C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil, p. 241, pl. xxxii. figs. 6–8.

Type. Detached vertebra; Brussels Museum.

A provisional species founded upon vertebræ very similar to those of the living *Cetorhinus maximus*, and in which the calcified concentric rings are very numerous.

Form. & Loc. Pliocene (Crag): Antwerp, Belgium.

P. 2316. Half of a typical vertebra, 0·095 in diameter, in section.
By exchange, 1883.

The following extinct species are also recognized upon imperfect evidence:—

Cetorhinus auratus: *Selache aurata*, R. Lawley, Atti Soc. Tosc. Sci. Nat. vol. iv. (1879), p. 109; F. Sacco, Bull. Soc. Géol. France, [3] vol. xiv. (1886), p. 364. *Hannovera aurata*, P. J. van Beneden, Bull. Acad. Roy. Sci. Belg. [2] vol. xxxi. (1871), p. 504, pl. ii. fig. 16; R. Lawley, Nuovi Studi, Pesci etc. Colline Toscane (1876), p. 44, pl. i. fig. 17 *c*. Teeth resembling *Selache maxima*, R. Lawley, *op. cit.* p. 89, pl. i. fig. 11.—Pliocene; Belgium and Italy. [Founded upon dermal appendages of gill-arches (see A. Hannover, Overs. k. Danske Vidensk. Selsk. Forhandl. 1867, p. 46, woodcut).]

Cetorhinus glauconiticus: *Selache glauconitica*, F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 49. *Selache* sp., C. Hasse, Palæontogr. vol. xxxi. (1884), p. 10, pl. ii. fig. 18.—Upper Eocene; Palmnicken and Samland, Prussia. [Founded upon a vertebra.]

Cetorhinus vetustus: *Selache vetusta*, O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 58, pl. vii. figs. 59, 63 (60).—Miocene; Naples. [Tooth.]

The so-called *Selache manzonii*, R. Lawley (*loc. cit.* vol. v. (1881), p. 167, woodcuts), from the Miocene of Monte Titano, Republic of San Marino, is founded upon a very doubtful tooth.

Large dermal spines identical with those affixed to the claspers of the existing male *Cetorhinus maximus* are described from the Crag of Antwerp by P. J. van Beneden, Bull. Acad. Roy. Sci. Belg. [2] vol. xlii. (1876), p. 294 (with plate). The following are similar specimens from the English Crag:—

46721. Short, broad, and robust spine; Red Crag, Woodbridge, Suffolk. *Purchased*, 1875.

48934-5. Imperfect, larger, and more elongated spine, and one small complete example; Red Crag. *Purchased*, 1878.

The following vertebræ are referable to members of the family Lamnidæ, but the generic determination of these fossils is somewhat uncertain:—

35157-9. Eight specimens; Cambridge Greensand, Cambridge. *Purchased*, 1859.

35350. Large vertebra, 0·07 in diameter, labelled *Otodus*? by Prof. Dr. Carl Hasse; Cambridge Greensand. *Purchased*, 1859.

35440-46. Seven vertebræ; Cambridge Greensand. *Purchased*, 1859.

41917. Seven vertebræ, the three largest labelled *Otodus* by Dr. Hasse; Cambridge Greensand. *Purchased*, 1870.

P. 1301 a. Two small vertebræ; (?) Cambridge Greensand. *Egerton Coll.*

P. 4647. Five large vertebræ: Cambridge Greensand. *Enniskillen Coll.*

P. 4646. Small vertebra, labelled *Otodus* by Dr. Hasse; Greensand, Tournai, Belgium. *Enniskillen Coll.*

35703. Large vertebra: Greensand, Folkestone, Kent. *Purchased*, 1859.

43084. Slightly smaller specimen; Gault, Folkestone. *Purchased*, 1871.

47214, P. 22. Twenty vertebræ, labelled *Otodus* by Dr. Hasse; Gault, Folkestone. *Gardner Coll.*

47230. Nine vertebræ, determined as *Oxyrhina* by Dr. Hasse; Gault, Folkestone. *Gardner Coll.*

P. 1301. Three large vertebræ, labelled *Otodus* by Dr. Hasse; (?) Gault, Folkestone. *Egerton Coll.*

47249. Vertebra; Chalk Marl, Dover. *Gardner Coll.*

47238. Larger vertebra; Grey Chalk, Dover. *Gardner Coll.*

4210. Vertebra 0·08 in diameter: Chalk, Sussex. *Mantell Coll.*

25938. Still larger, but imperfect vertebra, figured in Dixon's Foss. Sussex (1850), pl. xxxi. fig. 8; Chalk, Sussex. *Dixon Coll.*

25939. Slightly smaller vertebra, with fragment; Chalk, Sussex. *Dixon Coll.*

49015. Group of four imperfect vertebræ, one 0·088 in diameter, with fragments of others; Chalk, (?) Kent. *Mrs. Smith's Coll.*

P. 1300 a. Vertebra 0·09 in diameter, labelled *Otodus* by Dr. Hasse; Chalk, Kent or Sussex. *Egerton Coll.*

P. 5404. Similar imperfect vertebra; Chalk, near Lewes. *Presented by P. E. Coombe, Esq.*, 1888.

P. 5569. Group of four imperfect large vertebræ; Chalk, Folkestone. *Purchased*, 1888.

P. 5910. Group of ten vertebræ, somewhat smaller; Chalk, Kent or Sussex. *History unknown.*

33131. Similar vertebra; Chalk, Kent. *Purchased*, 1858.

P. 5610-11. Large vertebra, and group of small vertebræ; Chalk, Kent. *Harford Coll.*

47249 a. Fragmentary vertebra; Chalk, Dover. *Gardner Coll.*

25852. Vertebra 0·055 in diameter; Chalk, Sussex. *Dixon Coll.*

4144, 4145, 4194, 4206 4209, 4213. Four groups of still smaller vertebræ, two associated examples, and three detached specimens; Chalk, Sussex. *Mantell Coll.*

25798, 25853, 25879. Two associated vertebræ, 0·03 in diameter, labelled *Lamna* by Dr. Hasse; also two imperfect larger vertebræ; Chalk, Sussex. *Dixon Coll.*

49902. Two fragmentary similar vertebræ; Chalk, Amberley Pit, Arundel, Sussex. *Capron Coll.*

49017. Vertebra 0·035 in diameter; Chalk, Kent. *Mrs. Smith's Coll.*

49901. Two larger vertebræ; Chalk, Newtimber, Sussex. *Capron Coll*

P. 1300. Fragmentary vertebræ, labelled *Otodus* by Dr. Hasse; Chalk, Kent or Sussex. *Egerton Coll.*

P. 3200, P. 4641. Group of about fifteen vertebræ, mostly broken, averaging 0·042 in diameter, and assigned to *Otodus* by Dr. Hasse; also two smaller groups of fragments; Chalk, Kent. *Enniskillen Coll.*

49900. Three similar associated vertebræ, labelled *Otodus* by Dr. Hasse; Upper Chalk, Guildford. *Capron Coll.*

49899. Series of five vertebræ, 0·04 in diameter, labelled *Otodus* by Dr. Hasse; Upper Chalk, Glynde, near Lewes. *Capron Coll.*

49959. Fourteen associated vertebræ; English Chalk. *Capron Coll.*

42982. Vertebra: Maastricht Beds, Holland. *Van Breda Coll.*

28352. Imperfect vertebra, 0·102 in diameter; London Clay, Sheppey. *Dixon Coll.*

33197. Vertebra, 0·09 in diameter; Sheppey. *Purchased*, 1858.

38828–30. Three large vertebræ, respectively 0·1, 0·087, and 0·072 in diameter; Sheppey. *Bowerbank Coll.*

43125. Two equally large vertebræ; Sheppey. *Wetherell Coll.*

P. 1323. Large vertebra, 0·103 in diameter; Sheppey. *Egerton Coll.*

P. 4648–51. Ten imperfect vertebræ, mostly smaller; Sheppey. *Enniskillen Coll.*

28765. Vertebra, nearly 0·06 in diameter; Sheppey. *Purchased*, 1853.

38831–33. Five vertebræ, still smaller; Sheppey. *Bowerbank Coll.*

P. 617. Similar vertebra figured by Agassiz, Poiss. Foss. vol. iii. pl. xl. *b*. figs. 16, 17, under the name of *Lamna elegans*, and assigned to "*Otodus*" by Dr. Hasse; Sheppey. *Egerton Coll.*

P. 1302. Series of four similar vertebræ; Sheppey. *Egerton Coll.*

P. 5819. Series of three and series of five similar vertebræ; Sheppey. *Enniskillen Coll.*

P. 5820. Two vertebræ, much deeper than broad, labelled *Otodus* by Dr. Hasse; Sheppey. *History unknown.*

33308. Group of seven smaller vertebræ, about 0·03 in diameter; Sheppey. *Purchased*, 1858.

38834. Two small vertebræ; Sheppey. *Bowerbank Coll.*

P. 5821. Series of five small vertebræ, and another of thirteen; Sheppey. *History unknown.*

P. 5513. Group of five small vertebræ; Sheppey. *Caleb Evans Coll.*

25682. Three imperfect vertebræ; Bracklesham Beds, Bracklesham Bay. *Dixon Coll.*

25733 d. Two small vertebræ, labelled *Otodus* by Dr. Hasse; Bracklesham. *Dixon Coll.*

25678, 25679, 25717. Two vertebræ, assigned to *Oxyrhina* by Dr. Hasse; two others and a small group, to *Otodus*; Bracklesham. *Dixon Coll.*

29021. Series of five imperfect vertebræ; Bracklesham. *Cowderoy Bequest.*

P. 439. Two vertebræ; (?) Bracklesham. *Purchased*, 1882.

P. 1303. Imperfect vertebra; Bracklesham. *Egerton Coll.*

P. 5587. Vertebra, 0·08 in diameter; Bracklesham. *Harford Coll.*

P. 5822. Small vertebra; Barton Clay, Barton Cliff.

28104 c. Small vertebra, assigned to *Oxyrhina* by Dr. Hasse: Eocene, South Carolina. *Purchased*, 1852.

P. 1311. Two imperfect small vertebræ; Molasse, Soleure, Switzerland. *Egerton Coll.*

P. 2318. Vertebra, in section, labelled *Otodus* by Dr. Hasse; Lower Miocene, Flonheim, Hessen-Darmstadt. *By exchange*, 1883.

P. 2319. Larger vertebra, in section, labelled *Oxyrhina* by Dr. Hasse; Flonheim. *By exchange*, 1883.

P. 2317. Portion of vertebra, in section; Rupelian Beds, Boom, near Antwerp, Belgium. *By exchange*, 1883.

The following specimens are also probably referable to large members of the family Lamnidæ:—

39435. Piece of cartilage, 0·155 in length, with very coarse tesseræ; Lower Chalk, Kent. *Bowerbank Coll.*

47945. Two pieces of similar cartilage: Lower Chalk, Burham, Kent. *Presented by the Hon. Robert Marsham*, 1877.

49939. Smaller piece of similar cartilage; Lower Chalk, Glynde, Sussex. *Capron Coll.*

49940. Another specimen; Chalk, Arundel, Sussex. *Capron Coll.*

42981. Two elongated pieces of cartilage: Maastricht Beds, Holland. *Van Breda Coll.*

4188. "Fragment de Squelette" (fossil of calcified cartilage), figured by L. Agassiz, Poiss. Foss. vol. iii. pl. x. *b*. fig. 6; Chalk, Lewes. *Mantell Coll.*

39062. Similar fossil figured by F. Dixon, Foss. Sussex, pl. xxxi. fig. 15: Chalk, Sussex. *Bowerbank Coll.*

42990. Smaller example: Danian Beds, Maastricht, Holland. *Van Breda Coll.*

Family CARCHARIIDÆ.

Dorsal fins without spines, the first situated opposite to the space between the pectoral and pelvic fins. Eye with a nictitating membrane. Teeth hollow when completely formed, usually pointed.

Genus **CARCHARIAS**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 125.]

Syn. *Carcharinus*, H. D. de Blainville, Bull. Soc. Philom. 1816, p. 121 (in part).

Snout produced forwards; mouth crescent-shaped, the labial groove or fold being confined to, or not extending much beyond, the angle of the mouth. Spiracles absent. A pit at the root of the caudal fin, which has a distinct lower lobe. Teeth with a single sharp cusp, mostly compressed and triangular; upper teeth usually differing much from the lower teeth.

According to the characters of the dentition, five subgenera are distinguished, as follow:—

A. None of the teeth serrated.

i. *Scoliodon*, Müller & Henle (Syst. Beschreib. Plagiostom. 1841, p. 27).

Upper and lower teeth oblique, not swollen at the base.

ii. *Physodon*, Müller & Henle (*op. cit.* p. 30).

Lower teeth swollen at the base, points slender: upper teeth compressed, triangular, oblique.

iii. *Aprionodon*, Gill (Ann. Lyc. Nat. Hist. New York, vol. vii. 1862, pp. 401, 411). *Aprion*, Müller & Henle, *op. cit.* p. 31.

Teeth narrow, on a broad base; the lower erect, the upper erect or only slightly oblique.

B. Some or all of the teeth serrated.

iv. *Hypoprion*, Müller & Henle (*op. cit.* p. 34).

Lower teeth not serrated, upper only serrated at the base.

v. *Prionodon*, Müller & Henle (*op. cit.* p. 35). *Glyphis*, L. Agassiz, Poiss. Foss. vol. iii. 1843, p. 243.

Some or all the teeth entirely serrated.

i. SCOLIODON.

Carcharias (Scoliodon) orpiensis (Winkler).

1876. *Notidanus orpiensis*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. p. 12, pl. i. figs. 13–17.

1876. *Notidanus orpiensis*, A. Rutot, Ann. Soc. Roy. Malacol. Belg. vol. xi. p. 29, pl. i. fig. 3.

Type. Detached teeth.

Teeth with a broad, low crown, the anterior margin arched and the posterior margin deeply notched. Faint traces of serrations occasionally observable upon the anterior coronal margin, more frequently upon the posterior margin below the notch.

Form. & Loc. Lower Eocene: Belgium and England.

P. 4104. Two teeth; Woolwich and Reading Beds.
Presented by Sydney C. Cockerell, Esq., 1883.

P. 5742. Two teeth; Lower Heersian Beds, Orp-le-Grand, Belgium.
Presented by G. F. Harris, Esq., 1888.

Carcharias (Scoliodon) eocænus, sp. nov.

Type. Detached teeth; British Museum.

Teeth of considerable size, broad and triangular, much compressed; dental crown with very slightly excavated posterior margin.

Form. & Loc. London Clay: Highgate, London.

43135. Two type specimens, the larger measuring 0·01 across the base; Highgate Archway. *Wetherell Coll.*

The following specimens also appear to be referable to this subgenus:—

40242. Fifteen minute teeth; Barton Clay, High Cliff, Hampshire.
Edwards Coll.

P. 4501a. Small imperfect tooth, deeply notched posteriorly; Pliocene, Antibes, S. France.

Presented by Miss Battersby, 1883.

The following extinct species has also been determined upon the evidence of detached teeth, but there are no examples in the Collection:—

Carcharias (*Scoliodon*) *kraussi*, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 120, pl. i. figs. 7–11.—Molasse; Baltringen, Würtemberg.

A tooth of an undetermined species, from the Miocene of Naples, is also figured by O. G. Costa, Paleont. Regno Napoli.pt.ii.(1854-56), pl. vii. fig. 62 (*Corax appendiculatus*).

Some small teeth from the Plänerkalk of Bohemia originally described under the name of *Oxyrhina heteromorpha* by A. E. Reuss (Verstein. böhm. Kreideform. pt. i. 1845. p. 7. pl. iii. figs. 14–16) were subsequently assigned by the same author (*op. cit.* pt. ii. 1846. p. 100. pl. xxiv. figs. 23, 24. pl. xlii. figs. 10–12) to *Scoliodon*, with the name of *S. priscus*. By later authors, however, these teeth are ascribed to *Oxyrhina gugnetiformis*, Reuss (see p. 380).

Vertebræ from the Molasse of Switzerland and Würtemberg are also described as referable to this subgenus by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil. p. 270. pl. xxxix. fig. 5.

A shark from the Upper Eocene of Monte Bolca, near Verona, having a dentition very suggestive of that of *Scoliodon*, is made the type of a distinct genus, *Protogaleus*, R. Molin (Sitzungsb. math.-nat. Cl. k. Akad. Wiss. Wien, vol. xl. 1860, p. 585), subsequently named *Abopiopsis* P. Lioy (Atti Soc. Ital. Sci. Nat. vol. viii. 1865, p. 403). The type species is the following:—

Protogaleus cuvieri, R. Molin, *tom. cit.* p. 583: *Squalus carcharias*, Volta (*non* Risso), Ittiolit. Veron. (1796), pl. iii. fig. 1: *Squalus fasciatus*, Volta (*non* Bloch), *op. cit.* pl. lxvii. fig. 1: *Galeus cuvieri*, L. Agassiz, Poiss. Foss. vol. iv. (1839), p. 33 (name only): *Abopiopsis plejadon*, P. Lioy, *tom. cit.* p. 404. pl. iv. *Abopiopsis cuvieri*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. iii. (1874), p. 199.

iii. APRIONODON.

Carcharias (Aprionodon) gibbesii, sp. nov.

1849. *Galeocerdo minor*, R. W. Gibbes (*non* Agassiz), Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 192, pl. xxv. figs. 63–65.

(?) 1849. *Oxyrhina minuta*, R. W. Gibbes (in part), *tom. cit.* p. 202, pl. xxvii. fig. 164.

Type. Detached teeth.

A species of moderate size, the teeth comparatively robust and broad, the coronal margin often feebly crimped upon the basal extensions.

Form. & Loc. Eocene: South Carolina and Alabama, U.S.A.

28103. About seventy-five teeth; South Carolina. *Purchased*, 1852.

47006. Two teeth; South Carolina. *Purchased*, 1876.

P. 5747. Seven teeth; South Carolina. *History unknown.*

P. 1220. Six teeth; South Carolina. *Egerton Coll.*

P. 1220 a. Eleven teeth; Clarke's Co., Alabama. *Egerton Coll.*

P. 2338. Twenty teeth; Clarke's Co., Alabama. *Enniskillen Coll.*

The following specimen may also be referred to this subgenus:—

36330. Large tooth, measuring 0·02 across the base, having the lateral extensions of the crown faintly plicated; named *Lamna eurybathrodon*, C. C. Blake, The Geologist, vol. v. (1862), p. 316; Miocene, Aspinwall, Darien.
Purchased, 1862.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Carcharias (*Aprionodon*) *acanthodon*: *Galeocerdo acanthodon*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. 1871, p. 9, woodcut.—Pliocene; Belgium.

(?) *Carcharias* (*Aprionodon*) *basisulcatus*: *Oxyrhina basisulcata*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. (1849), p. 45, pl. ii. fig. 40; O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 83, pl. vii. figs. 19, 20, 25 (*non* fig. 18).—Miocene; Turin.

Carcharias (*Aprionodon*) *brevis*, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 122, pl. i. fig. 4.—Molasse; Baltringen, Würtemberg.

Carcharias (*Aprionodon*) *frequens*, W. Dames, Sitzungsb. k. preuss. Akad. Wiss. 1883, pt. i. p. 143, pl. iii. fig. 7 *a*–*p*.—Lower Tertiary; Birket-el-Qurūn, Egypt.

Carcharias (*Aprionodon*) *stellatus*, J. Probst, *tom. cit.* p. 121, pl. i. figs. 1–3.—Molasse; Baltringen.

iv. HYPOPRION.

The upper teeth of this subgenus are scarcely distinguishable from those of *Galeus*, and extinct species are thus difficult of deter-

mination. The following specimens, however, probably represent an unknown Eocene form:—

P. 4104 a. Three small teeth, one showing three broad posterior denticulations; Woolwich and Reading Beds, Chislehurst, Kent. *Presented by Sydney C. Cockerell, Esq.*, 1883.

The following species has also been founded upon detached teeth, but there are no examples in the Collection:—

Carcharias (*Hypoprion*) *singularis*, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 123, pl. i. figs. 5, 6.—Molasse; Baltringen.

Another tooth, from the Tertiary of Ngembak, Java, has been doubtfully assigned to this subgenus by K. Martin, Samml. geol. Reichs-Mus. Leiden, [1] vol. iii. (1883), p. 30, pl. ii. fig. 24.

v. PRIONODON.

Carcharias (**Prionodon**) **egertoni** (Agassiz).

1837. *Carcharias minor*, L. Agassiz in Egerton's List of Fossil Fishes.
1843. *Corax egertoni*, L. Agassiz, Poiss. Foss. vol. iii. p. 228, pl. xxxvi. figs. 6, 7.
1847. *Glyphis subulata*, R. W. Gibbes, Proc. Acad. Nat. Sci. Philad. p. 268.
1849. *Galeocerdo egertoni*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 192, pl. xxv. figs. 66–69.
1849. *Glyphis subulata*, R. W. Gibbes, *tom. cit.* p. 194, pl. xxv. figs. 86, 87.

Type. Detached teeth; British Museum.

Upper teeth broad, triangular, prominently serrated, both margins slightly concave. Lower teeth probably narrower than the upper, robust, and prominently serrated.

Form. & Loc. Eocene: South Carolina, U.S.A. Miocene: Maryland, U.S.A.

P. 2351. Type specimen, figured by Agassiz, *tom. cit.* pl. xxxvi. fig. 6; Maryland. *Enniskillen Coll.*

P. 494. Larger tooth, figured *ibid.* fig. 7; Maryland. *Egerton Coll.*

P. 2352. Still larger tooth: Maryland. *Enniskillen Coll.*

41331. Two small teeth, one relatively narrow; Maryland. *Purchased*, 1869.

P. 5746. Three teeth; probably from Maryland or South Carolina.

47002. Tooth: Phosphate Beds, South Carolina. *Purchased*, 1876.

Teeth have also been assigned to *C. egertoni* from the Lower Tertiary of Birket-el-Qurūn, Egypt (W. Dames, Sitzungsb. k. preuss. Akad. Wiss. 1883, pt. i. p. 142, pl. iii. fig. 5); from the Miocene of Naples (O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 65, pl. vii. fig. 29); and from the Pliocene of Tuscany (R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane, 1876, p. 14, and Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, 1881, p. 136, pl. i. (*Galeocerdo*), fig. 2, pl. ii. fig. 1, pl. iii. fig. 7); but the evidence is insufficient to render the determinations certain. The species is retained in *Corax* by Dames and Costa, but assigned to *Galeocerdo* by Lawley, the latter having determined the hollowness of the Italian teeth.

Carcharias (**Prionodon**) **aculeatus** (Davis).

1888. *Galeocerdo aculeatus*, J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. iv. p. 8, pl. i. figs. 1–3.

Type. Detached teeth; Canterbury Museum, Christchurch, New Zealand.

Lower teeth with a narrow elevated crown suddenly expanding at its base over a broad root; marginal serrations especially large and prominent at the base.

Form. & Loc. Pareora and Oamaru Systems: New Zealand.

42019. Two teeth, one almost destitute of serrations, and evidently referable to the symphysis; Canterbury, New Zealand. *Presented by J. Davies Enys, Esq.*, 1870.

P. 2308 b. Large imperfect tooth; Otatara series, Trelissic, Canterbury. *By exchange*, 1876.

The following detached teeth of the subgenus *Prionodon* are also preserved in the Collection:—

10556. High-crowned, oblique upper tooth, prominently serrated, and deeply notched posteriorly; Cretaceous, New Jersey, U.S.A. *Mantell Coll.*

47020. Three teeth, resembling those named *Galeocerdo egertoni* by Lawley; Pliocene, Orciano, Tuscany. *Purchased*, 1875.

47009. Lower tooth, in form suggestive of the subgenus *Aprionodon*, but with finely serrated coronal edges; Phosphate Beds, South Carolina. *Purchased*, 1876.

Teeth of the subgenus *Prionodon* have also been described under the following names, but there are no examples in the Collection:—

Carcharias (*Prionodon*) *acutus*, L. Agassiz, Poiss. Foss. vol. iii.

(1843), p. 242, pl. xxxvi. figs. 8, 9.—"Marnes de la craie de Bockum," Westphalia.

Carcharias (*Prionodon*) *angustidens*, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 129, pl. i. figs. 25, 26.—Molasse; Baltringen, Würtemberg.

Carcharias (*Prionodon*) *antiquus*, L. Agassiz, Amer. Journ. Sci. [2 vol. xxi. (1856), p. 273.—Tertiary; Ocoya Creek, California.

Carcharias (*Prionodon*) *armatus*, J. Probst, *tom. cit.* p. 133, pl. i. figs. 32–36.—Molasse; Baltringen.

Carcharias (*Prionodon*) *baltringensis*, J. Probst, *tom. cit.* p. 135, pl. i. figs. 40–42.—Molasse; Baltringen.

Carcharias (*Prionodon*) *defrancii*, J. Probst, *tom. cit.* p. 128, pl. i. fig. 22.—Molasse; Baltringen.

Carcharias (*Prionodon*) *diffi*, K. Martin, Samml. geol. Reichs-Mus. Leiden, [1] vol. iii. (1883), p. 28, pl. ii. figs. 21–23.—Tertiary; Ngembak, Java.

Carcharias (*Prionodon*) *desdayesi*: *Glyphis desdayesi*, M. Rouault, Comptes Rendus, vol. xlvii. (1858), p. 191; H. E. Sauvage, Mém Soc. Sci. Nat. Saône-et-Loire, vol. iv. (1882), p. 52.—Faluns; Bretagne, France.

Carcharias (*Prionodon*) *exsecans*: *Galeocerdo exsecans*, R. Lawley, Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo* (1881), p. 142, pl. iii. (*Galeocerdo*). figs. 1–6, 8, 9: *Carcharodon minimus*, R. Lawley, Nuovi Studi Pesci, etc. Collane Toscane (1876), p. 24.—Pliocene; Tuscany. (?=*Galeocerdo egertoni*, Lawley.)

Carcharias (*Prionodon*) *gibbus*: *Galeocerdus gibbus*, O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 62, pl. vii. fig. 14.—Miocene; Naples.

Carcharias (*Prionodon*) *hastalis*: *Glyphis hastalis*, L. Agassiz, *tom. cit.* p. 244, pl. xxxvi. figs. 10–13.—London Clay; Sheppey.

Carcharias (*Prionodon*) *javanus*, K. Martin, *tom. cit.* (1883), p. 27, pl. ii. figs. 19, 20.—Tertiary; Ngembak, Java.

(?) *Carcharias* (*Prionodon*) *modestus*, V. Kiprijanoff, Bull. Soc. Imp. Nat. Moscou, 1854, pt. ii. p. 375, pl. ii. fig. 2.—Cenomanian; Kursk, Russia.

Carcharias (*Prionodon*) *modestus*, J. Probst, *tom. cit.* p. 129, pl. i. figs. 23, 24.—Molasse; Baltringen.

Carcharias (*Prionodon*) *orpiensis*: *Glyphis orpiensis*, A. Daimeries, Ann. Soc. Roy. Malacol. Belg. 1888, Proc.-Verb., p. liv (name only).—Heersian Beds; Belgium.

Carcharias (*Prionodon*) *pedemontanus*: *Corax pedemontanus*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. (1849), p. 31, pl. i. figs. 19–24.—Upper Tertiary; Piedmont.

Carcharias (*Prionodon*) *similis*, J. Probst, *tom. cit.* p. 125, pl. i. figs. 12–19. Molasse; Baltringen.

Carcharias (*Prionodon*) *speciosus*, J. Probst, *tom. cit.* p. 127, pl. i. figs. 20, 21.—Molasse: Baltringen.

Carcharias (*Prionodon*) *subglaucus*, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 19.—Pliocene; Tuscany.

Carcharias (*Prionodon*) *sublamia*, R. Lawley, *op. cit.* 1876, p. 20. —Pliocene; Tuscany.

Carcharias (*Prionodon*) *tenuis*, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 242, pl. xxx. *a*. fig. 15; (?) R. Lawley, *op. cit.* 1876, p. 21.—Senonian; Sentis, Canton St. Gall, Switzerland.

Carcharias (*Prionodon*) *tumidus*, J. Probst, *tom. cit.* p. 134, pl. i. figs. 37–39.—Molasse; Baltringen.

(?) *Carcharias* (*Prionodon*) *ungulatus*, J. Probst, *tom. cit.* p. 131, pl. i. figs. 27–31: *Glyphis ungulata*, G. von Münster, Beitr. Petrefakt. vii. (1846), p. 22, pl. ii. fig. 18.—Molasse; Baltringen. Miocene; Neudörfl, Vienna.

Carcharias (*Prionodon*) *urcianensis*: *Glyphis urcianensis*, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 20.—Pliocene; Tuscany.

Teeth of an undetermined species, from the Miocene of Naples, are also figured by O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), pl. vii. figs. 36, 37 (*Corax appendiculatus*). Others, from the Siwalik Formation of the Punjab, India, are described by R. Lydekker, Pal. Ind. [10] vol. iii. (1886), p. 242, pl. xxxv. figs. 12–15.

Vertebræ of *Prionodon*, from the Bruxellian Beds of Belgium, are also described by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 273, pl. xxxix. figs. 14–20.

The so-called *Galeocerdo sismondæ*, G. G. Gemmellaro (Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. 1857, p. 294, pl. i. *a*. fig. 7 *a*), seems to be founded upon a tooth-fragment of *Carcharodon*; but to this species has been referred a tooth of a true *Prionodon* from the Pliocene of Tuscany (R. Lawley, Studi Comp. &c. 1881, p. 140, pl. i. (*Galeocerdo*), fig. 3, pl. ii. fig. 2).

Genus **GALEOCERDO**, Müller & Henle.

[Syst. Beschreib. Plagiostom. 1841, p. 59.]

Syn. *Galeodes*, J. J. Heckel, Sitzungsb. math.-nat. Cl. k. Akad. Wiss. Wien, vol. xi. (1854), p. 324.

Snout short; mouth crescent-shaped, the labial groove inconspicuous. Spiracles minute. A pit on the tail, above and below, at the commencement of the caudal fin: the latter with a double notch. Teeth subequal in both jaws, oblique, serrated on both margins, with a deep notch posteriorly.

The fossil teeth of this genus, being found detached, can often be only doubtfully separated from those of certain species of *Carcharias*.

Galeocerdo contortus, Gibbes.

1849. *Galeocerdo contortus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 193, pl. xxv. figs. 71–74.

Type. Detached teeth.

A species of moderate size. Teeth very robust, with elevated crown; the apex above the posterior notch elongated, produced to a sharp point, more or less twisted; anterior margin arched, somewhat sinuous, and finely serrated; margin below the posterior notch short, with comparatively small serrations.

Form. & Loc. Eocene: South Carolina and Alabama, U.S.A. Miocene: Virginia and Maryland, U.S.A.

28100. Thirty-three teeth, some imperfect: Eocene, South Carolina. *Purchased*, 1852.

47001. Tooth; South Carolina. *Purchased*, 1876.

P. 1213. Two teeth; South Carolina. *Egerton Coll.*

P. 2347. Three teeth: probably from South Carolina. *Enniskillen Coll.*

P. 4098. Six teeth; Charleston, South Carolina. *By exchange*, 1883.

P. 5748. Six teeth: probably from South Carolina.

35610. Five teeth, more or less imperfect: Eocene, Alabama. *Presented by Prof. J. W. Mallet*, 1859.

P. 2349. Tooth; Alabama. *Enniskillen Coll.*

P. 2348. Tooth: Miocene, Maryland. *Enniskillen Coll.*

41333. Tooth; Miocene, Maryland. *Purchased*, 1869.

Galeocerdo latidens, Agassiz.

1843. *Galeocerdo latidens*, L. Agassiz, Poiss. Foss. vol. iii. p. 231, pl. xxvi. figs. 22, 23 (? figs. 20, 21).

(?) 1849. *Galeocerdo latidens*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 192, pl. xxv. figs. 59–62.

1850. *Galeocerdo latidens*, F. Dixon, Foss. Sussex, p. 202, pl. xi. figs. 22, 23.

1883. *Galeocerdo latidens*, W. Dames, Sitzungsb. k. preuss. Akad. Wiss. pt. i. p. 142.

Type. Detached tooth; Paris Museum.

Teeth broad, mostly low-crowned, the largest measuring about 0·024 across the base. Anterior coronal margin only slightly arched, except near the apex; apex above the posterior notch small, narrow; margin below the posterior notch long, straight and much inclined; root large. Serrations of the coronal margin very prominent.

Form. & Loc. Bracklesham Beds: Sussex. Bruxellian Beds: Belgium (*Winkler*). Lower Tertiary: Birket-el Qurūn, Egypt (*Dames*). Eocene: South Carolina (*Gibbes*). Miocene: Maryland (*Gibbes*)[1].

25677. Five teeth; Bracklesham Beds, Bracklesham Bay, Sussex. *Dixon Coll.*

P. 1209. Tooth; Bracklesham. *Egerton Coll.*

P. 2346. Three teeth; Bracklesham. *Enniskillen Coll.*

28080. Comparatively narrow high-crowned tooth, probably from the symphysis of the jaw of this species; Bracklesham. *Presented by F. E. Edwards, Esq.*, 1852.

Galeocerdo aduncus, Agassiz.

1842. *Notidanus biserratus*, G. von Münster, Beitr. Petrefakt. v. p. 66, pl. xv. fig. 9.

1843. *Galeocerdo aduncus*, L. Agassiz, Poiss. Foss. vol. iii. p. 231, pl. xxvi. figs. 24–28.

1844. *Galeocerdo aduncus*, P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. p. 283, pl. i. figs. 12, 13.

[1] Teeth probably not of this species are also recorded under the name of *G. latidens* from the Miocene of Hérault (P. Gervais, Zool. et Pal. Franç. 1852, pl. lxxiv. fig. 7), and from the Lower Miocene of Sternberg, Mecklenburg (T. C. Winkler, Archiv Vereins Fr. d. Naturgesch. Mecklenburg, vol. xxix. 1875, p. 118, pl. ii. fig. 10.)

1840. *Galeocerdo aduncus*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 191, pl. xxv. figs. 54–58.

1850. *Galeocerdus rectus*, O. G. Costa, Paleont. Regno Napoli, pt. i. p. 111, pl. ix. fig. 5.

1852. *Galeocerdo aduncus*, P. Gervais, Zool. et Pal. Franç. pl. lxxiv. fig. 8.

(?) 1852. *Galeocerdo latidens*, P. Gervais, *op. cit.* pl. lxxiv. fig. 7.

1854–56. *Galeocerdus rectus*, O. G. Costa, *op. cit.* pt. ii. p. 59, pl. v. fig. 10.

1854–56. *Galeocerdus denticulatus*, O. G. Costa (*non* Agassiz), *op. cit.* pt. ii. p. 60, pl. vii. fig. 26.

1854–56. *Galeocerdus aduncus*, O. G. Costa, *op. cit.* pt. ii. p. 61, pl. vii. figs. 26–28.

1861. *Galeocerdo aduncus*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. xix. p. 463, pl. i. figs. 14, 15.

1871. *Galeocerdo aduncus*, H. Le Hon, Prélim. Mém. Poiss. Tert. Belg. p. 9.

1876. *Galeocerdo aduncus*, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane, p. 14.

1877. *Galeocerdo aduncus*, K. Miller, Das Molassemeer Bodenseegeg. p. 64, pl. iii. fig. 69.

1879. *Corax pristodontus*, F. Bassani (*non* Agassiz), Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 67.

1880. *Galeocerdo arcuatus*, F. Bassani, Boll. Soc. Veneto-Trent. Sci. Nat. vol. i. p. 149.

1881. *Galeocerdo aduncus*, R. Lawley, Studi Comp. Pesci foss. e i viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo*, p. 133, pl. i. (*Galeocerdo*), fig. 1.

1887. *Galeocerdo aduncus*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 85, fig. 90.

Type. Detached teeth; Museum of Carlsruhe.

A species with the dentition very similar to that of the existing *G. arcticus*, but of smaller size. Anterior coronal margin much arched and finely serrated; the apex above the posterior notch short, broad, and sharply directed backwards; margin below the posterior notch relatively short in the principal teeth, with large serrations.

Form. & Loc. Eocene: South Carolina and Alabama. Miocene: Switzerland, Germany, Malta, France, and Maryland. Pliocene: Tuscany and Belgium.

33313. Tooth; locality unknown.
Presented by S. P. Pratt, Esq., 1858.

P. 1212. Seven imperfect teeth; Miocene, Malta. *Egerton Coll.*

P. 2342. One tooth and three fragments; Molasse, Soleure, Switzerland. *Enniskillen Coll.*

28360. Much abraded posterior tooth, probably of this species: Faluns of Touraine. *Purchased*, 1853.

41332. Three teeth; Miocene, Maryland. *Purchased*, 1869.

35610. Two small hinder teeth; Eocene, Alabama.
Presented by Prof. J. W. Mallet, 1859.

P. 1211. Five teeth; Alabama. *Egerton Coll.*

P. 2344. Three broad teeth; Alabama. *Enniskillen Coll.*

35610 a. Eight teeth; Alabama.
Presented by Prof. J. W. Mallet, 1859.

P. 1210. Four teeth; Eocene, South Carolina. *Egerton Coll.*

P. 2345. Three teeth; South Carolina. *Enniskillen Coll.*

P. 5749. Seven teeth; South Carolina. *History unknown.*

P. 2343. Large tooth, with very prominent anterior serrations, doubtfully assigned to this species; South Carolina.
Enniskillen Coll.

Galeocerdo (?) minor, Agassiz.

1843. *Galeocerdo minor*, L. Agassiz, Poiss. Foss. vol. iii. p. 232, pl. xxvi. figs. 15–19 (? figs. 20, 21), pl. xxvi. *a*. figs. 64–66.
1860. *Protogaleus minor*, R. Molin, Sitzungsb. math.-nat. Cl. k. Akad. Wiss. Wien, vol. xl. p. 583.
1874. *Galeocerdo recticonus*, T. C. Winkler, Archiv. Mus. Teyler, vol. iii. p. 296, pl. vii. fig. 1.
1876. *Galeocerdus recticonus*, T. C. Winkler, *loc. cit.* vol. iv. p. 26.
1879. *Galeocerdo minor*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 64.

Type. Detached teeth.

A small species, the largest teeth probably not measuring more than 0·01 across the base. Crown much elevated, the apex above the posterior notch long, slender, and pointed; anterior margin almost straight, the serrations large and confined to its basal half; margin below the posterior notch short, with few large serrations.

Form. & Loc. Molasse: Switzerland. Miocene: France. Eocene: Belgium, S.E. England, and Alabama, U.S.A.[1]

[1] A number of teeth from the Miocene of Naples, probably for the most part referable to *Carcharias*, are also assigned to this species by O. G. Costa, Paleont. Regno Napoli, pt. ii. (1854–56), p. 63, pl. v. fig. 13, pl. vii. figs. 15, 16, 17, 34, 35, 39, 40, 61.

35542. Three teeth; Rupelian Beds, Klein Spauwen, Belgium. *Purchased*, 1859.

P. 4931. Three small teeth; Laekenian Beds, St. Gilles, near Brussels. *Presented by G. F. Harris, Esq.*, 1885.

P. 5913. Six teeth; Bruxellian Beds, Woluwe St. Lambert, Brussels. *Presented by Mons. A. Houzeau de Lehaie*, 1889.

40245. Two teeth; Barton Clay, High Cliff, Hampshire. *Edwards Coll.*

3134. Five teeth; London Clay, Highgate Archway, near London. *Wetherell Coll.*

P. 1211 a. Tooth. Eocene, Alabama. *Egerton Coll.*

A single tooth from the London Clay of Highgate Archway, near London (No. **43135 a**. *Wetherell Coll.*) may possibly represent an unknown small species of *Galeocerdo*.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Galeocerdo capellini. R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 16; Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo* (1881), p. 145, pl. i. (*Galeocerdo*). fig. 6, pl. ii. fig. 5.—Pliocene; **Tuscany.**

Galeocerdo crassidens. E. D. Cope, Proc. Amer. Phil. Soc. 1872, p. 355.—Niobrara Formation; Smoky Hill, Kansas. (? *Prionodon*.)

(?) *Galeocerdo dubius*. F. Noetling, Abh. Geol. Specialk. Preussen u. Thüring. Staaten, vol. vi. pt. 3 (1885), p. 97, pl. v. fig. 6.—Upper Eocene: Sandland, Prussia. (? *Prionodon*.)

Galeocerdo denticulatus, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 233, pl. xxvi. fig. 1: *Prionodon*?, L. Agassiz, Amer. Journ. Sci. [2 vol. xxi. (1856), p. 274.—Danien: Maastricht, **Holland.**

Galeocerdo gibberulus. L. Agassiz, *tom. cit.* p. 232, pl. xxvi. *a*. figs. 62, 63.—"Chalk Marl": Haldem, Westphalia.

Galeocerdo hartvellii. E. D. Cope, *tom. cit.* p. 356.—Niobrara Formation; **Smoky Hill, Kansas.**

Galeocerdo javanus, K. Martin, Samml. geol. Reichs-Museum Leiden, [1 vol. iii. (1883), p. 24, pl. ii. fig. 15.—Tertiary; **Ngembak, Java.**

Galeocerdo lavissimus, E. D. Cope, Proc. Acad. Nat. Sci. Philad. 1867, p. 141.—Miocene; United States.

(?) *Galeocerdo maretsensis*, T. C. Winkler, Archiv. Mus. Teyler, vol. iv. (1876), p. 10, pl. i. figs. 10, 11, 12.—Heersian Beds; Belgium. (? *Prionodon*.)

Galeocerdo priscus (Zigno), F. Bassani, Rend. R. Accad. Sci. Fis. e Matem. 1888, p. 375: *Galeodes priscus*, J. J. Heckel, Sitzungsb. math.-nat. Cl. k. Akad. Wiss. Wien, vol. xi. (1854), p. 324.—Upper Eocene; Chiavon, Vicentin, Italy.

Galeocerdo productus, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 273.—Tertiary; Ocoya Creek, California.

Galeocerdo sublævis, G. von Münster, Beitr. Petrefakt. vii. (1846), p. 20: *Galeus sublævis*, G. von Münster, *op. cit.* v. (1842), p. 66.—Miocene; Vienna Basin.

Galeocerdo vincenti, A. Daimeries, Ann. Soc. Roy. Malacol. Belge, Proc.-Verb., June 1888, p. liv (name only).—Heersian Beds; Belgium.

Fossil vertebræ of *Galeocerdo* have been described by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882). Some resembling those of the existing *G. tigrinus* are recorded from the Molasse of Baltringen, Würtemberg (p. 260, pl. xxxvi. fig. 17), and the Crag of Antwerp (p. 260, pl. xxxvi. fig. 18); others resembling those of the existing *G. arcticus* are recorded from the Swiss Molasse (p. 262, pl. xxxvii. figs. 25, 26), and from the Miocene of Germany and France (p. 262, pl. xxxvii. figs. 27–32). Vertebræ from the Samland Eocene are also described by F. Noetling, *loc. cit.* p. 99, pl. ix. figs. 6–10.

Genus **HEMIPRISTIS**, Agassiz.

[Poiss. Foss. vol. iii. 1843, p. 237.]

Syn. *Dirrhizodon*, C. B. Klunzinger, Verhandl. k. k. zool.-bot. Gesell. Wien, vol. xxi. 1871, p. 664.

Principal teeth elevated and triangular, more or less curved or inclined backwards, with both coronal margins coarsely serrated, except towards the apex; root well-divided into two divergent branches. Upper teeth relatively large, broad, and flat; anterior lower teeth slender, subulate, inwardly curved, and destitute of denticulations or with one or two minute points at the base.

This genus was originally founded by Agassiz upon fossil teeth from the Molasse of Würtemberg, but a living species of the fish (*H. elongatus*) has subsequently been discovered in the Red Sea.

The latter is named *Dirrhizodon*, by Klunzinger (*loc. cit.*), but, as remarked by Probst [1], its dentition is generically identical with that of the extinct form.

Hemipristis serra, Agassiz.

1843. *Hemipristis serra*, L. Agassiz, Poiss. Foss. vol. iii. p. 237, pl. xxvii. figs. 18–30.

1843. *Hemipristis paucidens*, L. Agassiz, *tom. cit.* p. 238, pl. xxvii. figs. 31–33.

1844. *Hemipristis serra* and *H. paucidens*, P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. pp. 284, 285, pl. i. figs. 19–22.

(?) 1844. *Oxyrhina cyclodonta*, P. M. Pédroni, *tom. cit.* p. 288, pl. i. figs. 36–38.

1846. *Hemipristis serra* and *H. paucidens*, G. von Münster, Beitr. Petrefakt. vii. p. 21.

1849. *Hemipristis serra*, E. Sismonda, Mem. R. Accad. Sci. Torino, [2] vol. x. p. 33, pl. i. figs. 17, 18.

1849. *Hemipristis serra*, R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. p. 193, pl. xxv. figs. 75–85.

1849. *Lamna* (*Odontaspis*) *hopei*, R. W. Gibbes (*non* Agassiz), *tom. cit.* p. 198, pl. xxvi. figs. 120–123.

1850. *Hemipristis serra*, O. G. Costa, Paleont. Regno Napoli, pt. i. p. 114, pl. ix. figs. 3, 4.

1852. *Hemipristis serra*, P. Gervais, Zool. et Pal. Franç. pl. lxxiv. figs. 1–4.

1852. *Hemipristis paucidens*, P. Gervais, *op. cit.* pl. lxxiv. fig. 5.

1854–56. *Hemipristis paucidens*, O. G. Costa, *op. cit.* pt. ii. p. 67, pl. v. fig. 12, pl. vii. figs. 30–33.

1854–56. *Hemipristis minutus*, O. G. Costa, *op. cit.* pt. ii. p. 68, pl. vii. figs. 43, 45 (? fig. 44).

1854–56. *Hemipristis serra*, O. G. Costa, *op. cit.* pt. ii. p. 69, pl. vii. figs. 46–48.

1857. *Hemipristis serra*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 296, pl. i. *a*. fig. 6 *a*.

1857. *Glyphis scacchii*, G. G. Gemmellaro, *tom. cit.* p. 298, pl. i. *a*. figs. 8, 9.

1875. *Odontaspis sulcari*, H. E. Sauvage, Bull. Soc. Géol. France, [3] vol. iii. p. 634, pl. xxii. fig. 2.

1876. *Hemipristis serra*, R. Lawley, Nuovi Studi Pesci, etc. Collina Toscane, p. 18.

1877. *Hemipristis serra*, A. Leeard, Faune Terr. Tert. Moy. Corse, p. 1.

1878. *Hemipristis serra*, J. Probst, Württ. Jahresh. vol. xxxiv. p. 143, pl. i. figs. 49–57.

1879. *Hemipristis serra*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 63.

[1] Württ. Jahresh. vol. xxxiv. (1878), p. 141.

1879. *Odontaspis sacheri*, F. Bassani, *tom. cit.* p. 59, pl. v. fig. 17.
1882. *Odontaspis sacheri*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 51.
1882. *Hemipristis serra*, H. E. Sauvage, *tom. cit.* p. 53.
(?) 1883. *Hemipristis serra*, K. Martin, Samml. geol. Reichs-Mus. Leiden, [1] vol. iii. p. 26, pl. ii. fig. 17.
1884. *Hemipristis serra*, E. Nicolis, Mem. Accad. Agricolt. Arti e Comm. Verona, pl. ii. fig. 9.
1887. *Hemipristis serra*, K. A. von Zittel, Handb. Palæont. vol. iii. p. 85, fig. 89.

Type. Detached teeth; Museums of Tübingen, Stuttgart, Carlsruhe, Florence, and Paris.

The type species, of large size. Marginal serrations in the broad upper teeth large, extending almost to the apex, which is gently curved backwards. Cutting-edges of the anterior lower teeth very sharp distally. Inner face of root bulging inwards, with a deep cleft.

The synonymy given above seems proved by the dentition of the existing *H. elongatus*.

Form. & Loc. Eocene: South Carolina. Miocene: Germany, Austria, Italy, Sicily, Malta, Corsica, Switzerland, France, Maryland, and Virginia. Pliocene: Tuscany (*Lawley*). (?) Tertiary: Ngembak, Java.

P. 5750. Nineteen broad teeth; Molasse, Baltringen, Würtemberg. *Purchased*, 1859.

P. 2337. Anterior lower tooth; Molasse, probably from Otmarsingen, Aargau, Switzerland. *Enniskillen Coll.*

P. 2336. Three imperfect dental crowns; Molasse, Soleure, Switzerland. *Enniskillen Coll.*

28370. Tooth; Miocene (?), Bordeaux. *Purchased*, 1853.

P. 5751. Tooth and fragment; Miocene, St. Juvat, near Dinan.

32736. Broad tooth and imperfect dental crown: Miocene, Lisbon. *Presented by J. S. Valentine, Esq.*, 1857.

P. 1217, P. 1219. Six broad teeth and one narrow example; Miocene, Malta. *Egerton Coll.*

P. 1253. One anterior lower tooth, and three imperfect examples; Malta. *Egerton Coll.*

P. 2335, P. 4561. Six imperfect teeth, and one anterior lower tooth; Malta. *Enniskillen Coll.*

33329. Large tooth, probably of this species, noticed by C. C. Blake, 'The Geologist,' vol. v. p. 316; Miocene, Aspinwall, Darien, Central America. *Purchased*, 1862.

41334–5. Two broad upper, and two narrow lower teeth; Miocene, Maryland, U.S.A. *Purchased*, 1869.

28099. Twelve anterior lower teeth; Phosphate Beds, South Carolina, U.S.A. *Purchased*, 1852.

28102. Thirty-two teeth; South Carolina. *Purchased*, 1852.

47000. Three broad teeth; South Carolina. *Purchased*, 1876.

47004. Three anterior lower teeth; South Carolina. *Purchased*, 1876.

P. 1215. P. 1218. Five teeth; South Carolina. *Egerton Coll.*

P. 4097. Four teeth: South Carolina. *By exchange*, 1883.

P. 1218 a. Small tooth, doubtfully of this species; Eocene, Clarke's Co., Alabama, U.S.A. *Egerton Coll.*

P. 5857. Large anterior lower tooth, doubtfully of this species; Phosphate Beds, South Carolina. *Presented by John B. Martin, Esq.*, 1888.

The following species have also been founded upon detached teeth, but there are no examples in the Collection:—

Hemipristis curvatus, W. Dames, Sitzungsb. k. preuss. Akad. Wiss. 1883, pt. i. p. 140, pl. iii. fig. 4.—Lower Tertiary; Birket-el-Qurūn, Egypt.

Hemipristis latecaplanus, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 274.—Tertiary; Ocoya Creek, California.

Hemipristis klunzingeri, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 146, pl. i. figs. 58–63.—Molasse; Baltringen, Würtemberg.

(?) *Hemipristis subserratus*, G. von Münster, Beitr. Petrefakt. vii. (1846), p. 21.—Cenomanian; Regensburg, Bavaria.

A very doubtful fragmentary tooth from the Cenomanian of Kursk, Russia, is named *Hemipristis plicatilis*, V. Kiprijanoff (Bull. Soc. Imp. Nat. Moscou, 1854, pt. ii. p. 373, pl. ii. fig. 1). Other teeth, certainly not of this genus, from the Corallian of Schnaitheim, Würtemberg, are named *Hemipristis hidens*, F. A. Quenstedt (Handb. Petrefakt. 1852, p. 169, pl. xiv. figs. 21, 22).

Vertebræ either of *Hemipristis* or *Hemigaleus*, from the Molasse

of Baltringen, are described by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 258, pl. xxxvi. fig. 8. Nearly similar vertebræ from the Crag of Antwerp are also assigned to *Homigaleus*, *op. cit.* p. 258, pl. xxxvi. figs. 9–11.

Genus **GALEUS**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 127.]

Snout short; mouth crescent-shaped. Spiracles minute. No pit at the commencement of the caudal fin: the latter with a single notch. Teeth equal in both jaws, with posterior notch and serrations.

As already remarked (p. 438), it is difficult to distinguish the teeth of this genus from those of the upper jaw of *Hypoprion*. The following specimens, however, may probably be placed here:—

43134 a. Three teeth; London Clay, Highgate, near London. *Wetherell Coll.*

40242 a, 40245. Five small teeth; Barton Clay, High Cliff, Hampshire. *Edwards Coll.*

The following extinct species are supposed to be indicated by various detached teeth, but there are no examples in the Collection:—

Galeus affinis, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 139, pl. i. figs. 64–70.—Molasse; Baltringen, Würtemberg.

Galeus cristatus, J. Probst, *tom. cit.* p. 140, pl. i. fig. 71.—Molasse; Baltringen. (? *Ginglymostoma.*)

Galeus maltzani, T. C. Winkler, Archiv Vereins Fr. Naturgesch. Mecklenburg, vol. xxix. (1875), p. 116, pl. ii. figs. 6–9.—Miocene; Sternberg.

Galeus pantanellii: *Galeocerdo pantanellii*, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 15; Studi Comp. Pesci foss. coi viv. generi *Carcharodon*, *Oxyrhina*, e *Galeocerdo* (1881), p. 149, pl. i. (*Galeocerdo*) fig. 5, pl. ii. fig. 4: *Galeocerdo minor*, R. Lawley (*non* Agassiz), *op. cit.* 1881, p. 147, pl. i. (*Galeocerdo*) fig. 4.—Pliocene; Tuscany.

Galeus tenuis, J. Probst, *tom. cit.* p. 140, pl. i. figs. 68–70.—Molasse; Baltringen.

Vertebræ from the Upper Cretaceous of Maastricht, Holland, and from the Crag of Antwerp, Belgium, are also assigned to

Galeus by C. Hasse, Natürl. Syst. Elasmobr., Besond. Theil (1882), p. 266, pl. xxxviii. figs. 8–18.

Teeth of the existing *Galeus canis*, Linn., from the Forest Bed of Norfolk, are described by E. T. Newton, Vertebrata of the Forest Bed Series (Mem. Geol. Surv. 1882), p. 130, pl. xix. fig. 7, and the striking similarity between these teeth and those of *Galeus affinis*, Probst, is remarked upon.

Genus **SPHYRNA**, Rafinesque.

[Ind. Ittiol. Siciliana, 1810, p. 60.]

Syn. *Cestrachion*, H. D. de Blainville, Bull. Soc. Philom. 1816, p. 121. *Zygæna*, G. Cuvier, Règne Animal, vol. ii. 1817, p. 127.

Anterior portion of the head broad, flattened and laterally elongated: eyes situated at the extremities of the lobes. Nostrils situated on the front edge of the head: mouth crescent-shaped; spiracles absent. A pit at the commencement of the caudal fin; the latter with a single notch. Teeth of both jaws similar, oblique, with a posterior notch, and margins smooth or serrated.

When found detached it is impossible to distinguish the teeth of this genus with certainty from those of *Carcharias*. The following species, however, is recognized.

Sphyrna prisca, Agassiz.

1843. *Sphyrna prisca*, L. Agassiz, Poiss. Foss. vol. iii. p. 234, pl. xxvi. *a*. figs. 35–50.

1844. *Sphyrna prisca*, P. M. Pâbrol, Actes Soc. Linn. Bordeaux, vol. xiii. p. 284, pl. i. figs. 15, 16.

1846. *Sphyrna serrata*, G. von Münster, Beitr. Petrefakt. vii. p. 20, pl. ii. fig. 18.

1850. *Sphyrna prisca*, O. G. Costa, Paleont. Regno Napoli, pt. i. p. 112, pl. ix. fig. 7.

(?) 1857. *Sphyrna prisca*, G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. p. 295, pl. i. *a*. fig. 5 *a*, pl. vi. *a*. fig. 3 *a*.

(?) 1858. *Sphyrna rameti*, M. Rouault, Comptes Rendus, vol. xlvii. p. 101.

(?) 1858. *Sphyrna serrata*, J. Probst, Wurtt. Jahresh. vol. xxxiv. p. 151, pl. i. fig. 45.

1879. *Sphyrna prisca*, F. Bassani, Atti Soc. Veneto-Trent. Sci. Nat. vol. vi. p. 65.

1882. *Sphyrna prisca*, H. E. Sauvage, Mém. Soc. Sci. Nat. Saône-et-Loire, vol. iv. p. 52.

1884. *Sphyrna prisca*, E. Nicolis, Mem. Accad. Agricolt. Arti e Comm. Verona, pl. ii. fig. 7.

1887. *Sphyrna serrata*, K. A. von Zittel, Handb. Paleont. vol. iii. p. 86, fig. 93.

Type. Detached teeth; Palæontological Museum, Munich.

A species of moderate size. Teeth broad, gently oblique, often erect, finely serrated.

Form. & Loc. Miocene: Malta, Austria, (?) Sicily, Italy, France, and Maryland, U.S.A.[1]

Some of the following teeth have narrow crowns, with non-serrated edges, and are quite indistinguishable from those of the typical *Aprionodon*: occurring, however, in the same beds as those named *Sphyrna prisca* and *S. serrata*, they are provisionally catalogued here.

P. 1222. Ten teeth, mostly imperfect; Malta. *Egerton Coll.*

P. 2340. Five imperfect teeth; Malta. *Enniskillen Coll.*

P. 1223. Eight teeth; Neudörfl-a.-d.-March, Vienna. *Egerton Coll.*

P. 2339, P. 2341. Nine teeth, some imperfect; Neudörfl. *Enniskillen Coll.*

28360. Four abraded teeth, of very similar form and proportions: Faluns of Touraine. *Purchased*, 1853.

41336. Very similar perfect tooth; Maryland. *Purchased*, 1869.

The following tooth is also probably referable to *Sphyrna*, of a larger species than *S. prisca*:—

P. 4501 b. Perfect tooth; Pliocene, Antibes, France. *Presented by Miss Battersby*, 1883.

The following very doubtful species are also founded upon detached teeth, of which there are no examples in the Collection:—

Sphyrna integra, J. Probst, Württ. Jahresh. vol. xxxiv. (1878), p. 152, pl. i. figs. 46, 47.—Molasse; Baltringen, Würtemberg.

Sphyrna lævis, J. Probst, *tom. cit.* p. 153, pl. i. fig. 48.—Molasse: Baltringen.

Sphyrna lata, L. Agassiz, Poiss. Foss. vol. iii. (1843), p. 235, pl. xxvi. *a*. figs. 58, 59. Form. & loc. unknown[2].

[1] Teeth are also assigned to this species by R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1849), p. 194, pl. xxv. figs. 88–90, from the Eocene of South Carolina; and by R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 17.

[2] Doubtful teeth are assigned to this species by P. M. Pédroni, Actes Soc. Linn. Bordeaux, vol. xiii. (1844), p. 284, pl. i. figs. 17, 18; R. W. Gibbes, Journ. Acad. Nat. Sci. Philad. [2] vol. i. (1849), p. 195, pl. xxv. figs. 91–93; and by G. G. Gemmellaro, Atti Accad. Gioenia Sci. Nat. [2] vol. xiii. (1857), p. 296, pl. vi. *a*. fig. 16 *a*. Also by R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 17.

Sphyrna magna, E. D. Cope, Proc. Acad. Nat. Sci. Philad. 1867, p. 142.—Miocene; United States.

A tooth very suggestive of this genus, from the Tertiary of Java, is also described by K. Martin, Samml. geol. Reichs-Mus. Leiden, [1], vol. iii. (1883), p. 25, pl. ii. fig. 16 (*Galeocerdo*, sp.?). Doubtful teeth, probably from the Swiss Molasse, are also recorded, without description, under the name of *Sphyrna dubia*, L. Agassiz, *tom. cit.* p. 235.

The so-called *Sphyrna denticulata*, Münster (Agassiz, *tom. cit.* p. 236, pl. xxvi. *a*. figs. 60, 61), is founded upon the anterior cone of a tooth of *Notidanus primigenius* of Tertiary age. *Sphyrna subserrata*, Münster (Beitr. Petrefakt. vii. (1846), p. 21, pl. ii. fig. 17), from the Miocene of Neudorf, Vienna, is evidently founded upon a tooth of *Squatina*, as remarked by Probst (*tom. cit.* p. 152).

Some vertebræ from the Swiss Molasse are also assigned to *Sphyrna*, by C. Hasse, Naturl. Syst. Elasmobr., Besond. Theil (1882), p. 275, pl. xxxix. fig. 26.

Genus **MUSTELUS**, Cuvier.

[Règne Animal, vol. ii. 1817, p. 127.]

Syn. *Galeorhinus*, H. D. de Blainville, Bull. Soc. Philom. 1816, p. 121 (incomplete definition).

Snout short: mouth crescent-shaped, with well-developed, long labial folds. Spiracles minute. No pit at the root of the caudal fin: second dorsal fin scarcely smaller than the first. Teeth small, numerous, obtuse or with indistinct cusps, pavement-like, and similar in both jaws.

Mustelus stefanii, R. Lawley, Nuovi Studi Pesci, etc. Colline Toscane (1876), p. 35, pl. ii. fig. 3.—Pliocene; Orciano, Tuscany.

Vertebræ from the Danian Beds of Ciply and the Crag of Antwerp, Belgium, are referred to *Mustelus* by C. Hasse, Naturl. Syst. Elasmobr., Besond. Theil (1882), p. 283, pl. xl. figs. 13–15.

The following vertebræ are referable to members of the family Carchariidæ, but the generic determination of these fossils is somewhat uncertain:—

35311 a. Eight small examples, labelled *Carcharias* by Prof. Dr. Carl Hasse; Eocene, Alabama.

Presented by Prof. J. W. Mallet, 1859.

P. 4644. Seven vertebræ, mostly larger, similarly labelled; Eocene, Clarke's Co., Alabama, U.S.A. *Enniskillen Coll.*

28104 d. Three small vertebræ, similarly determined: Eocene, South Carolina. *Purchased*, 1852.

25733 b. Two small vertebræ, similarly determined; Bracklesham Beds, Bracklesham Bay, Sussex. *Dixon Coll.*

P. 5286. Similar small vertebra; Bracklesham. *Egerton Coll.*

28883. Small vertebra; Barton Clay, Barton Cliff, Hampshire. *Daniels Coll.*

40271-3. Eight small vertebræ, similarly determined; Barton Cliff. *Edwards Coll.*

24599. Seven larger vertebræ, also labelled *Carcharias* by Dr. Hasse; Miocene, Malta. *Purchased*, 1850.

28104 a. Vertebra, labelled *Hemipristis* by Dr. Hasse; Eocene, South Carolina. *Purchased*, 1852.

28104 b. Imperfect vertebra, labelled *Galeocerdo* by Dr. Hasse: South Carolina. *Purchased*, 1852.

38924. Associated series of eleven small vertebræ, labelled *Galeocerdo* or *Hemigaleus* by Dr. Hasse; London Clay, Sheppey. *Bowerbank Coll.*

P. 1309. Vertebra, labelled *Galeocerdo* by Dr. Hasse; Eocene, South Carolina. *Egerton Coll.*

P. 4645 a. Two imperfect vertebræ, similarly determined; South Carolina. *Enniskillen Coll.*

P. 4645. Six vertebræ, similarly determined; Eocene, Alabama. *Enniskillen Coll.*

P. 1304. Eight vertebræ, mostly larger than the foregoing, labelled *Hemigaleus*? by Dr. Hasse; Miocene, Malta. *Egerton Coll.*

P. 5571. Four transversely oval vertebræ, measuring 0·025 across; Woolwich Beds, Charlton, Kent. *Presented by R. W. Cheadle, Esq.*, 1888.

P. 5752. Two large transversely-oval vertebræ, labelled *Galeus* by Dr. Hasse, and the largest measuring 0·068 across; Eocene, Alabama. *Enniskillen Coll.*

1965. Similar vertebra; Miocene, Malta. *Presented by Miss Attersoll.*

28353, 24599. Two smaller and less oval vertebræ, and one fragment; Malta. *Dixon Coll.*, and *Purchased*, 1850.

41771. One oval and four smaller rounder vertebræ; Malta. *Purchased*, 1869.

P. 1310, P. 1310 a. Two large abraded oval vertebræ; Malta. *Egerton Coll.*

P. 4564. Similar specimen and three fragments; Malta. *Enniskillen Coll.*

1142 (Sloane Cat.). Vertebra 0·032 in diameter: Phosphate Beds, South Carolina. *Sloane Coll.*

46382 a. Small vertebra, labelled *Carcharias?* by Dr. Hasse: Lower Greensand, Farringdon, Wiltshire. *Cunnington Coll.*

Vertebræ of fossil Carchariidæ, from the Molasse of Baltringen, are described by J. Probst, Württ. Jahresh. vol. xliii. (1886), p. 308, pl. ix. figs. 6–10.

ADDENDA ET CORRIGENDA.

P. 26. Dr. J. S. Newberry has lately described a Shark with Cladodont dentition from the Erie Shale of Ohio, under the name of *Cladodus lepheri* (Trans. New York Acad. Sci. vol. vii. no. 7, 1888).

P. 29, line 30, for *Pristicladodus* read *Dicrenodus*.

P. 31. *Add*:—*Centrina calpica*, O. G. Costa, Paleont. Regno Napoli, Append. I.a. (1859), p. 105, pl. vi. fig. 9.—Tertiary; Naples.

P. 32. To *Acanthias* have also been assigned two doubtful fossils, certainly not of this genus. The so-called *Acanthias mesophanes*, P. Gervais (Zool. et Pal. Gén. 1867–69, p. 235, woodc. figs. 32, 33), from the Pliocene of Mont-

pellier, seems to be founded upon a Chimæroid fin-spine; the supposed spine from the Miocene of Turin, named *A. bicarinatus*, E. Sismonda (Mem. R. Accad. Sci. Torino, [2] vol. x. 1849, p. 28, pl. ii. figs. 41–43), is indeterminable.

P. 33. *Add*:—*Scyllium occidentalis*, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 272.—Tertiary; Ocoya Creek, California.

P. 34. The earliest publication of *Echinorhinus*, Blainville, is Bull. Soc. Philom. 1816, p. 121.

Add:—*Echinorhinus blakei*, L. Agassiz, Amer. Journ. Sci. [2] vol. xxi. (1856), p. 272.—Tertiary; Ocoya Creek, California.

P. 39. *Add*:—(?) *Antliodus sarcululus*, Newberry & Worthen, Pal. Illinois, vol. iv. (1870), p. 356, pl. ii. fig. 8.—Burlington Limestone; Iowa.

P. 47. *Add*:—*Petalodus levis*, H. Trautschold, Mém. Soc. Imp. Nat. Moscou, vol. xiii. (1874), p. 293, pl. xxviii. fig. 9.—Carboniferous Limestone; Mjatschkowa, Moscow.

P. 48. *Add*:—*Chomatodus incrassatus*, St. John & Worthen, Pal. Illinois, vol. vi. (1875), p. 359, pl. x. fig. 18.—St. Louis Limestone; Illinois.

P. 54. An indeterminable fossil from the Upper Silurian and Devonian of the Harz Mts. is also named *Ctenoptychius hercyniæ*, C. Giebel, Abh. Naturw. Vereins Prov. Sachsen u. Thüring. vol. i. (1858), p. 263, pl. i. fig. 2.

P. 57. According to F. M'Coy (Brit. Palæoz. Foss. p. 636), *Petalodus marginalis*, L. Agassiz (Poiss. Foss. vol. iii. p. 174, name only) is a synonym of *P. rectus*.

P. 60. *Add*:—*Polyrhizodus rossicus*: *Dactylodus rossicus*, A. A. Inostrantzeff, Trudui St. Peterb. Obshsch. Estest.-Ispuit. vol. xix. (1888), p. 1, pl. i. figs. 1–6.—U. Carboniferous Limestone; Government of Olonetz, Russia.

P. 61. The genus *Cymatodus*, Newberry & Worthen (Pal. Illinois, vol. vi. 1870, p. 363), is founded upon a tooth very suggestive of *Janassa*, from the Upper Coal-Measures of Illinois; the type species being *C. oblongus*, Newberry & Worthen (*tom. cit.* p. 364, pl. iv. fig. 7).

P. 65. The type-species of *Phorcynis*, from the Lithographic Stone of Cirin, Ain, France, is named *P. catulina*, Thiollière, *ibid.*

P. 75. *Add*:—*Pristis ambloden*, E. D. Cope, Proc. Boston Soc. Nat. Hist. vol. xii. (1869), p. 312.—Eocene; New Jersey.

P. 75. *Add*:—*Pristis attenuatus*, E. D. Cope, in W. C. Kerr's Rep. Geol. Surv. N. Carolina, vol. i. (1875), Appendix, p. 29. —Tertiary; N. Carolina.

Pristis brachyodon, E. D. Cope, Proc. Boston Soc. Nat. Hist. vol. xii. (1869), p. 312, and in W. C. Kerr, *op. cit.*—Greensand; Virginia.

P. 86. *Raja similis*.—See explanation of Plate IV.

P. 88. *Add*:—*Raja dux*, E. D. Cope, Proc. Acad. Nat. Sci. Philad. 1867, p. 141.—Miocene; United States, America.

P. 89. *Add*:—*Platyrhina bolcensis*, R. Molin, Sitzungsb. math.-phys. Cl. k. Akad. Wiss. Wien, vol. xl. (1860), p. 587: *Narcopterus bolcanus*, L. Agassiz, Poiss. Foss. vol. iii. p. 382** (name only).—Upper Eocene; Monte Bolca.

P. 90. *Torpedo gigantea* has also received the name of *Narcine gigantea*, R. Molin, Sitzungsb. math.-phys. Cl. k. Akad. Wiss. Wien, vol. xl. (1860), p. 585.

P. 108. *Add*:—*Psammodus bretonensis*, J. F. Whiteaves, Canadian Naturalist, vol. x. (1881), p. 36.—Coal-Measures; Nova Scotia.

A species of *Psammodus* (*P. antiquus*, Newberry) from the Devonian Corniferous Limestone of Ohio is also described in the Bull. National Institute, 1857 (*teste* J. S. Newberry, Rep. Geol. Surv. Ohio, vol. i. pt. ii. p. 265).

P. 131. *Add*:—*Goniobat's agassizii*, R. Blanchet, Bull. Soc. Vaudoise, vol. vi. (1860), p. 472, with plate.—Molasse; Molière, Switzerland.

Plinthicus, E. D. Cope (Proc. Boston Soc. Nat. Hist. vol. xii. 1869, p. 316), doubtfully distinct from *Actobatis*. The type species is *P. stenodon*, E. D. Cope, *ibid.*—Miocene; New Jersey.

P. 143. Agassiz recognizes four varieties of the teeth of *Ptychodus polygyrus* (*loc. cit.*), three of which, he suggests, may be named *P. concentricus*, *P. marginalis*, and *P. sulcatus*, if they eventually prove to be distinct species.

P. 205. *Add*:—*Pœcilodus foveolatus*, F. M'Coy, Ann. Mag. Nat. Hist. [2] vol. ii. (1848), p. 129, and Brit. Palæoz. Foss. (1855), p. 639, pl. 3 G. fig. 11; J. W. Davis, Trans. Roy. Dublin Soc. [2] vol. i. (1883), p. 445, pl. liii. fig. 26.—Carboniferous Limestone; Derbyshire.

P. 228. A doubtful tooth, from the Keokuk Limestone of Illinois, is also named *Chomatodus? costatus*, Newberry and Worthen, Pal. Illinois, vol. ii. (1866), p. 85, pl. v. fig. 17.

P. 259. The type specimen of *Hybodus dalabchei* is now preserved in the Museum of Practical Geology, Jermyn Street.

P. 270. The tooth figured in Quenstedt's 'Jura' under the name of *Hybodus grossiconus* received the subspecific name of *diprion*, ibid.

P. 278. An imperfectly defined genus, *Xystrodus*, Plieninger (*non* Agassiz), is proposed for some Hybodont teeth from the Rhætic Bone-bed of Salzgitter, Hildesheim, the type species being *X. finitimus* (T. Plieninger, Neues Jahrb. 1860, p. 695).

P. 298. *Add*:—*Acrodus falsus*, C. G. Giebel, Neues Jahrb. 1848, p. 156.—Muschelkalk; Esperstädt, Thüringia.

P. 299. A tooth of the form of *Acrodus*, from the Lower Muschelkalk of Jena, is also described under the name of *Strophodus acrodiformis*, E. E. Schmid, Nova Acta Acad. Cæs. Leop.-Car. vol. xxix. no. 9 (1861), p. 13, pl. ii. fig. 1.

P. 321. *Add*:—*Strophodus rigauxi*, H. E. Sauvage, Cat. Poiss. Second. Boulonn. (1867), p. 53, pl. iii. fig. 7 (*Curtodus*). —Bathonian; Boulogne-sur-Mer.

P. 351, line 4, for *salentinus* read *salandianus*.

Among non-Elasmobranch fossils erroneously determined, and not already mentioned in the text, may be placed the following:—

Pristis dubius, G. von Münster, Beitr. Petrefakt. vii. (1846), p. 47.—Corallian; Hanover. [Probably a fin-ray of a Lepidotoid Ganoid.]

Hemicladodus unicuspidatus, J. W. Davis, Quart. Journ. Geol. Soc. vol. xl. (1884), p. 620, pl. xxvii. fig. 24.—Yoredale Rocks; Wensleydale, Yorkshire. [Fragment of splenial dentition of *Amphicentrum* or *Cheirodus*.]

In the earlier pages the Upper Cretaceous of Mount Lebanon, yielding fossil fishes, is identified with the Turonian (after Oscar Fraas and J. W. Davis); in the later pages the formation is assigned to the Senonian (after F. Noetling and W. Dames), the character of the fish-fauna being more in accordance with the latter determination.

ALPHABETICAL INDEX.

[*Note.*—The numbers of pages on which merely incidental references occur are printed in italics.]

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The specimens represented in the Plates are all preserved in the Collection, and bear the register-numbers placed in square brackets. Unless otherwise stated, the drawings are of the natural size.

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Cretaceous Squatina

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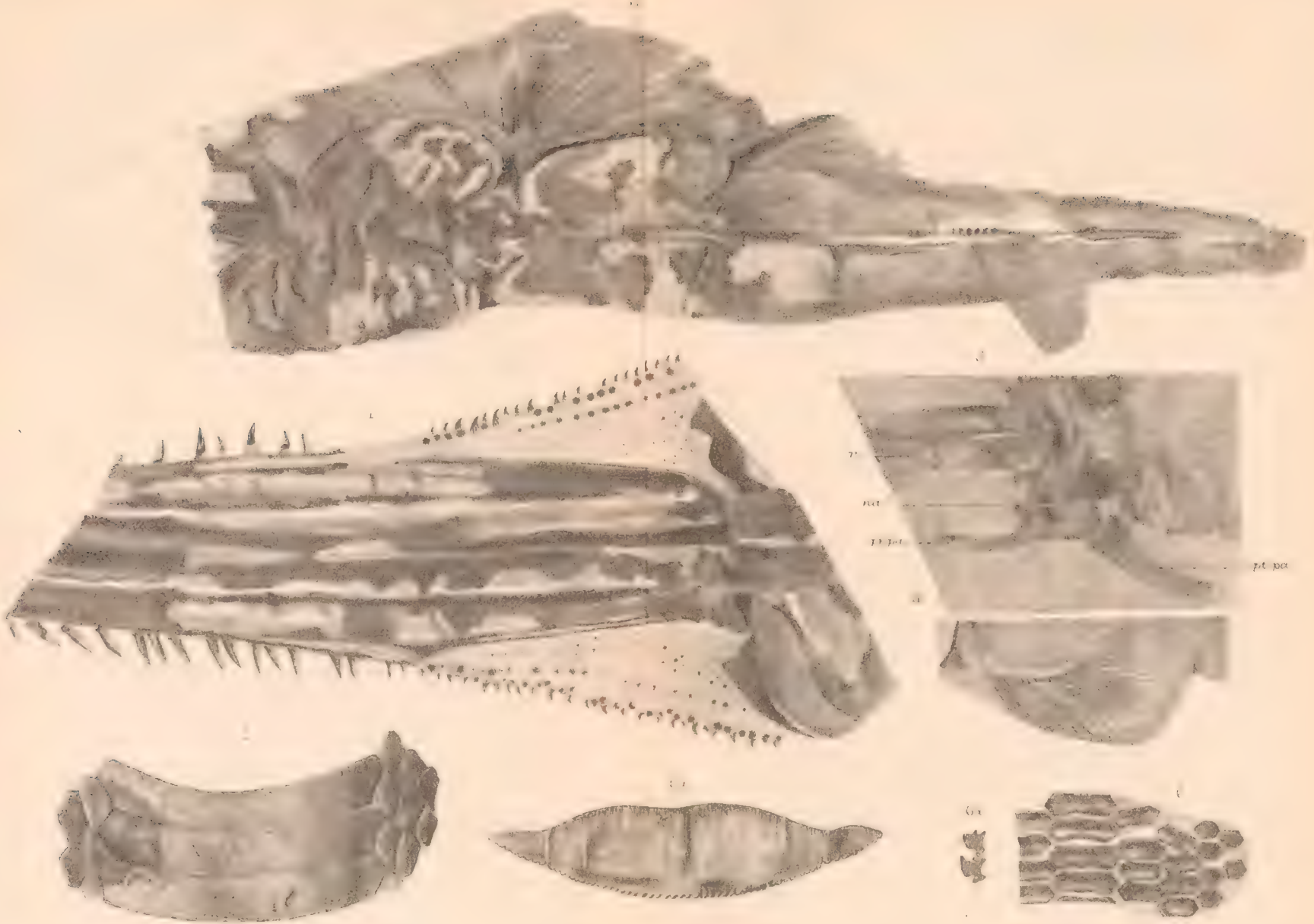

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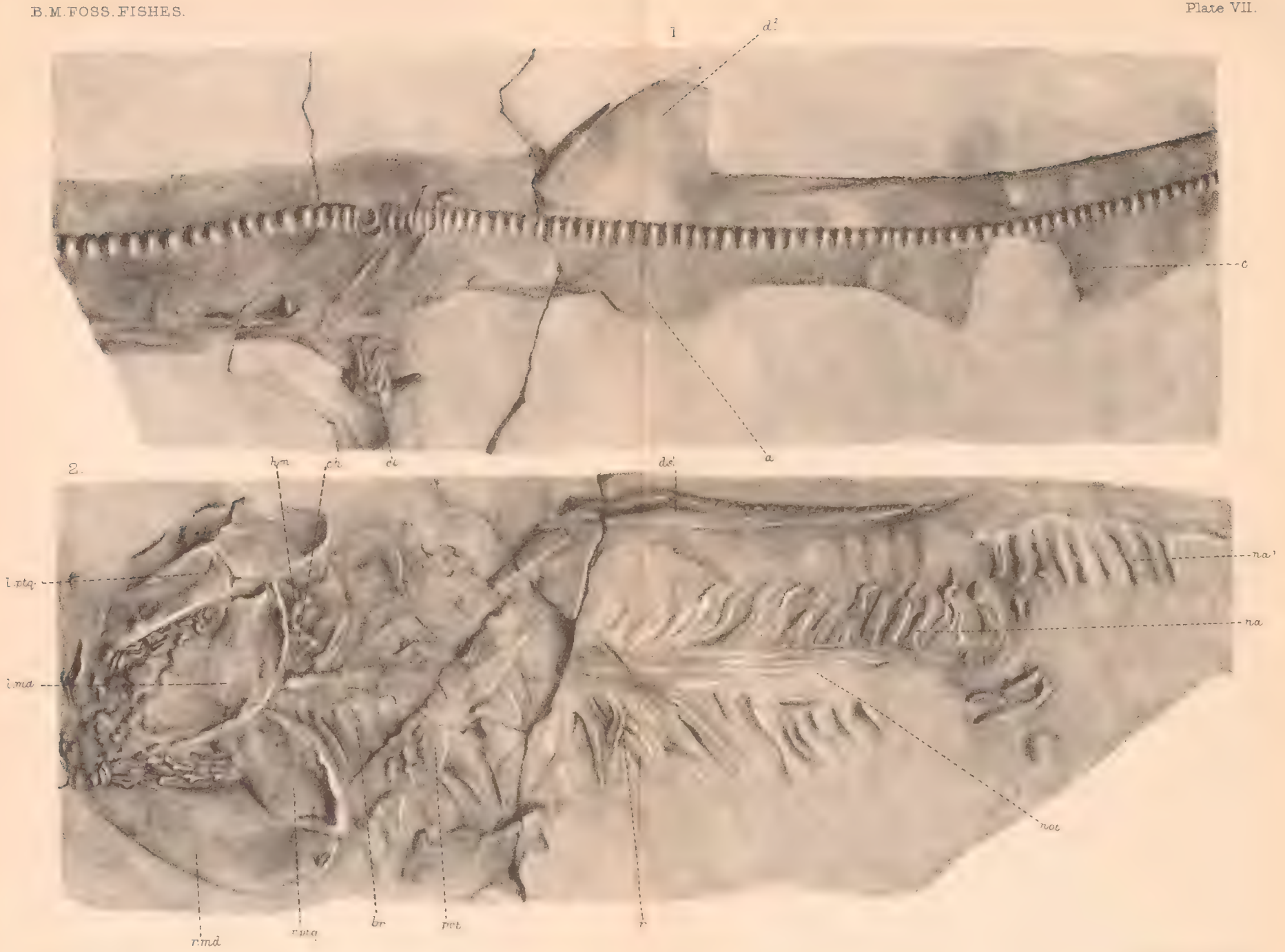

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Palæospinax and Hybodus

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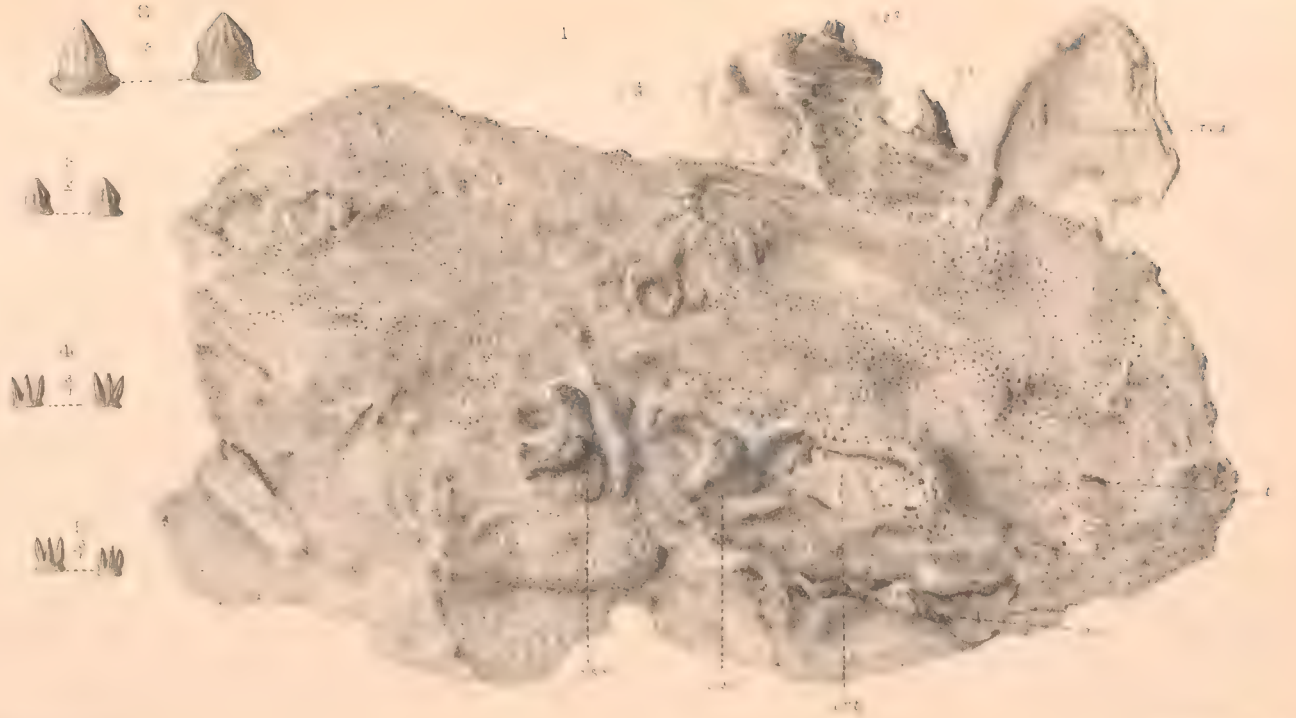

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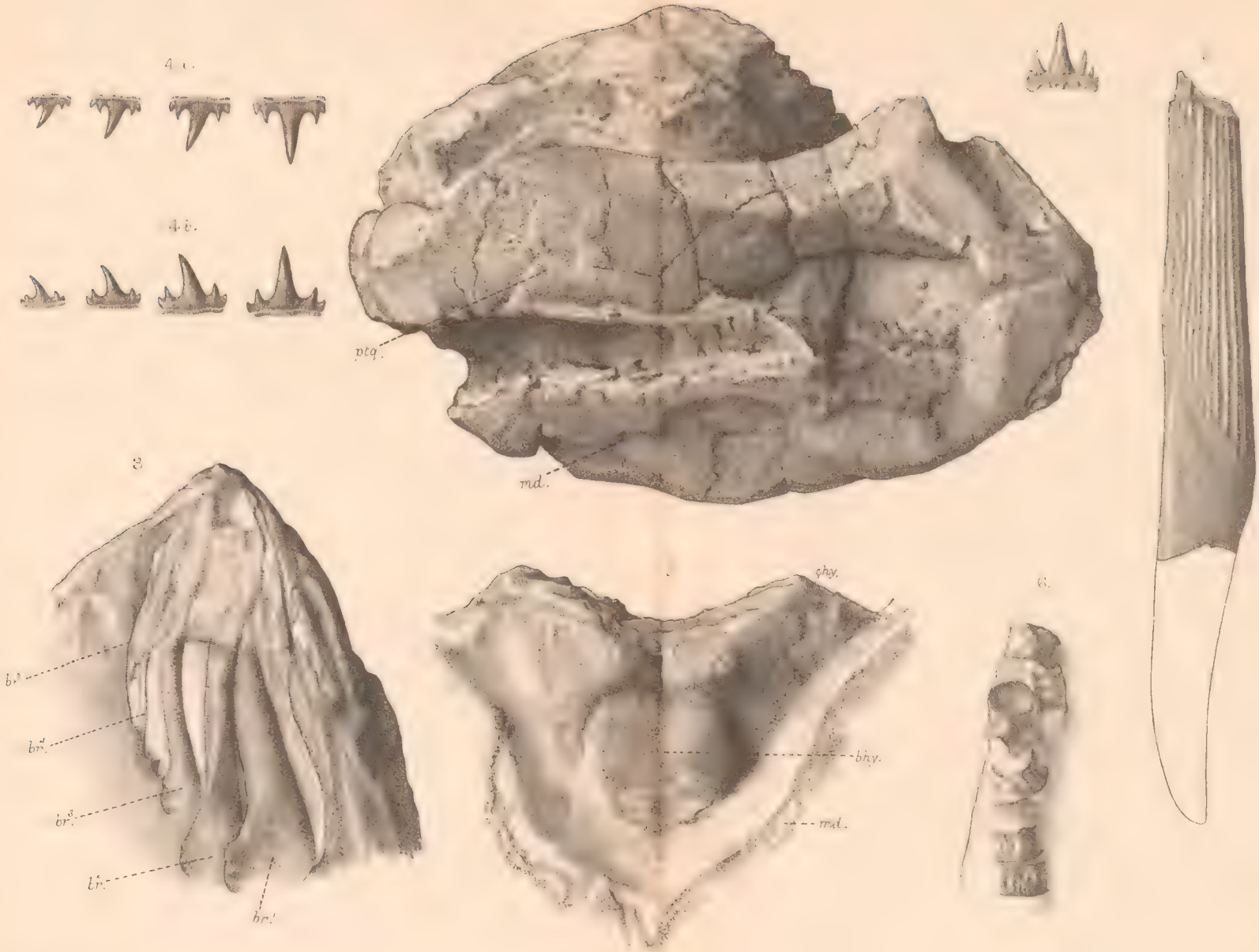

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Wealden and Cretaceous Hybodus

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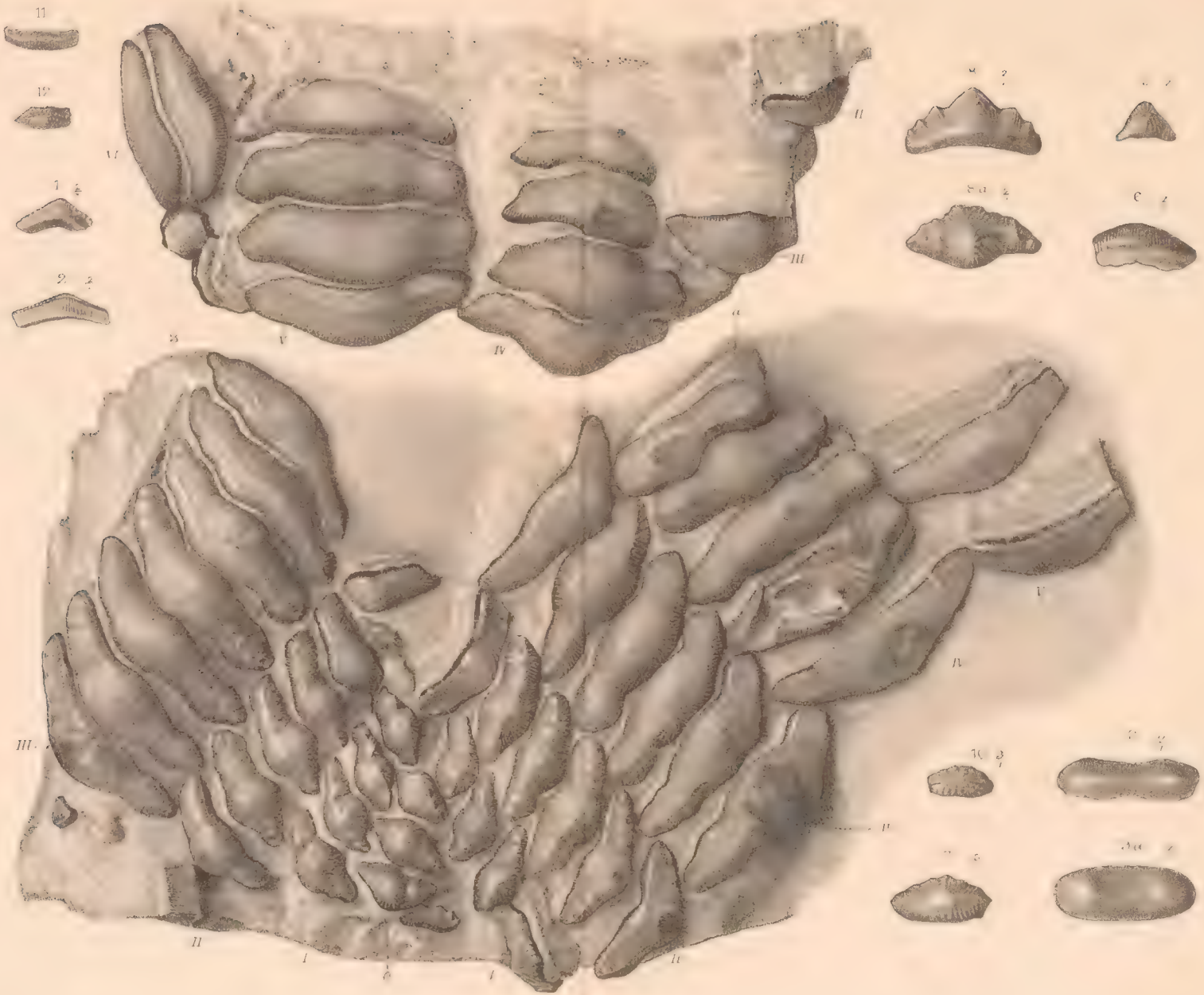

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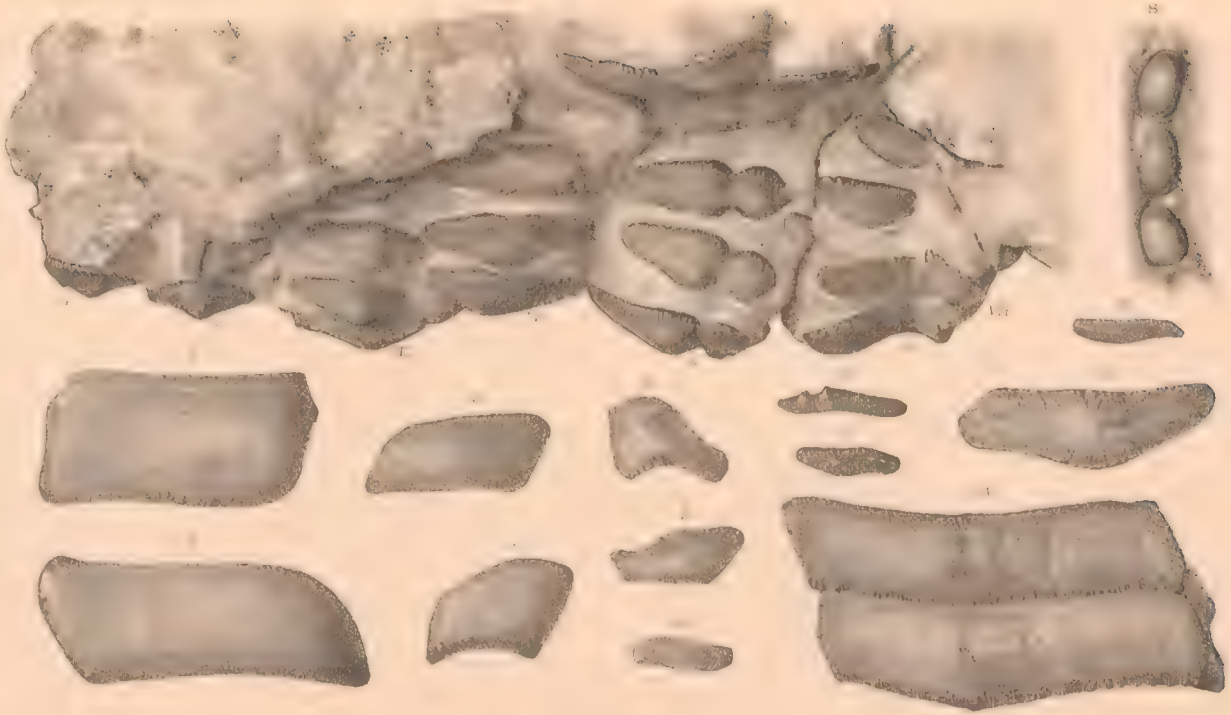

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Fig. Page

1. *Mesiteia sahel-almæ* (Pictet & Humbert); inferior and partly lateral aspect of fish.—Senonian; Sahel Alma, Mt. Lebanon. d^1, d^2. Dorsal fins. *f.* Fontanelle in cranial roof. *m.* Mouth. *p.pb.* Prepubic process of pelvic arch. *pct.* Pectoral arch and fins. *plv.* Pelvic arch and fins. [P. 4778, 48107.] 345

2. Ditto; tooth, outer aspect, twelve times nat. size.—Ibid. [46506.] 346

3. Ditto; portion of trunk, four times nat. size.—Ibid. *l.l.* Calcified dermal rings of lateral line. *r.* Ribs. *v.* Vertebræ. [48107.] 345

4. *Palæoscyllium minus*, sp. nov.; lateral aspect of fish, two thirds nat. size.—L. Kimmeridgian; Eichstädt, Bavaria. [P. 5541.] 339

5. *Scyllium elongatum* (Davis); portion of the upper and lower dentition, outer aspect, four times nat. size.—Senonian; Sahel Alma, Mt. Lebanon. [49521.] 341

6. *Scyllium* (?) *tumidens*, sp. nov.; tooth, outer aspect, six times nat. size.—Ibid. [P. 4777.] 342

7, 8. *Scyllium dubium*, sp. nov.; two associated teeth, inner and outer aspects, eight times nat. size.—L. Chalk, Dover. [47288.] 341

9. *Ginglymostoma serra* (Leidy); tooth, outer aspect.—Eocene; Clarke's Co., Alabama. [P. 1216.] 348

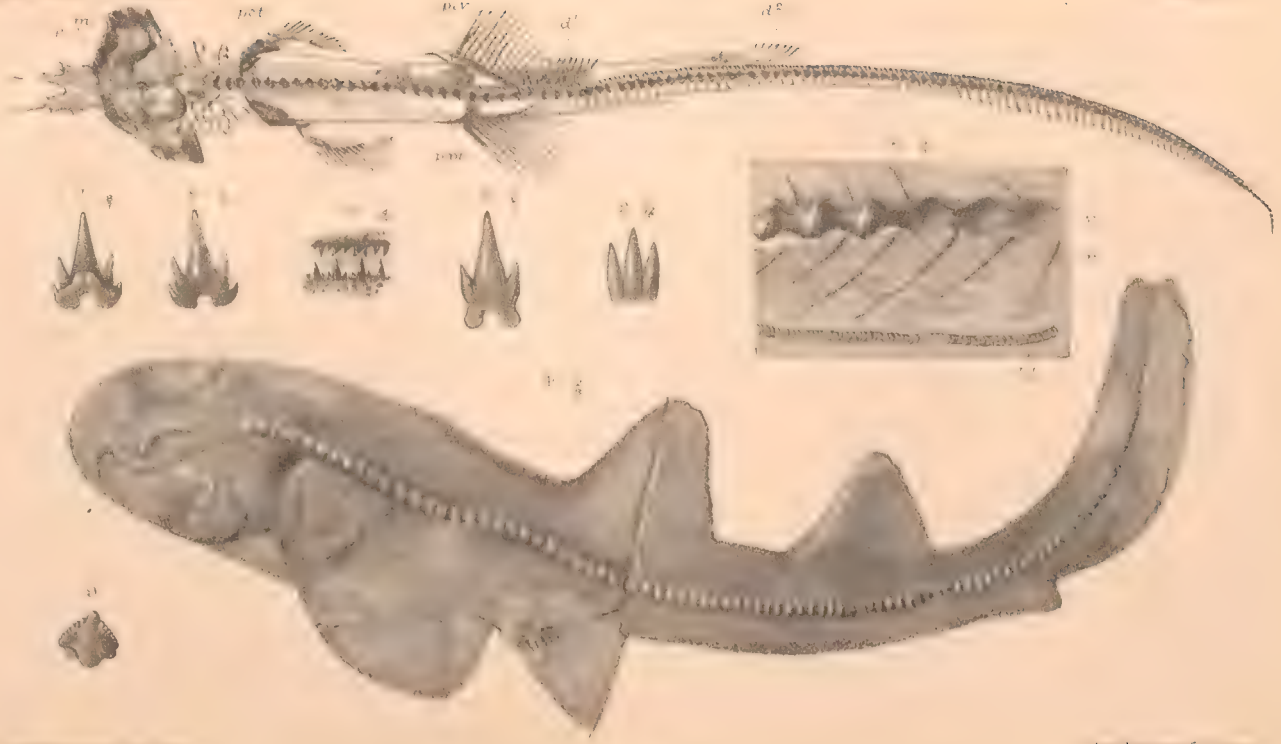


PLATE XVII.

Fig. Page

1. *Scapanorhynchus lewisii* (Davis); abdominal and caudal regions, lateral aspect, two thirds nat. size.—Senonian; Sahel Alma, Mt. Lebanon. *an.* Anal fin. *c.* Caudal fin. d^2. Posterior dorsal fin. *pct.* Pectoral fin. *plv.* Pelvic fin. [P. 4020.] 352

2. Ditto: head and branchial region, inferior aspect, two thirds nat. size.—Ibid. [49474.] 352

3. Ditto; crown of anterior tooth, lateral aspect, three times nat. size.—Ibid. [49551.] 352

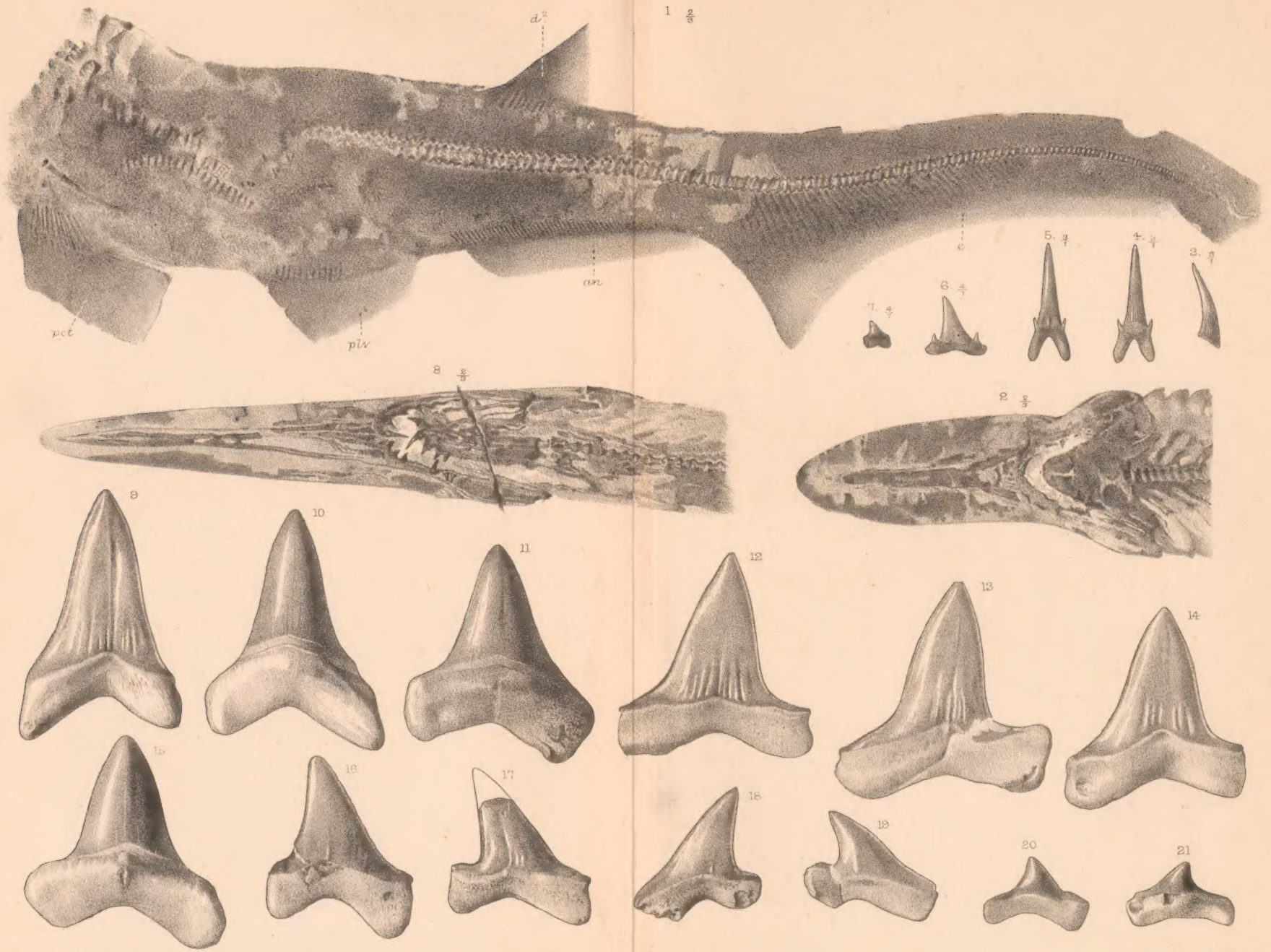
4, 5. Ditto; two anterior teeth, inner and outer aspects, three times nat. size.—Ibid. [49473.] 351

6. Ditto: lateral tooth, outer aspect, four times nat. size.—Ibid. [48099.] 351

7. Ditto; posterior tooth, outer aspect, four times nat. size. Ibid. [49475.] 352

8. *Scapanorhynchus elongatus*, sp. nov.; head and anterior portion of trunk, inferior aspect, two thirds nat. size.—Ibid. [P. 4774.] 353

9-21. *Oxyrhina mantelli*, Agassiz; associated series of thirteen teeth, outer and inner aspects.—Chalk; Grays, Essex. [32347, 39434.] 378



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